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LEPESME (P.). **Action de** *Bacillus prodigiosus* **et** *Bacillus pyocyaneus* **sur le criquet pélerin** (*Schistocerca gregaria* **Forsk.**).—*C. R. Soc. Biol.* **125** no. 19 pp. 492–494. Paris, 1937.

In the course of an epidemic that occurred in a batch of *Schistocerca gregaria*, Forsk., that was being reared in the laboratory, it was observed that *Bacillus prodigiosus* and *B. pyocyaneus* were present in the body fluids of affected locusts. Their effect on the locusts was therefore investigated by inoculating a pure culture of one or other of them into the body cavity. This caused death in 1–2 days; the bodies assumed a characteristic colouration varying from violet-pink to bright red, and putrefied rapidly. Ingestion of the same culture produced death only occasionally. Experiments showed that the virulence of the *Bacillus* was not increased by successive passages through the locusts.

DILL (W.). **Der Entwicklungsgang der mehligen Pflaumenblattlaus** *Hyalopterus arundinis* **Fabr. im schweizerischen Mittelland.** [The Course of Development of the mealy Plum Aphis, *H. arundinis*, in the Swiss Middlelands.]—*Mitt. Aargau naturf. Ges.* no. 20 pp. 157–240, 8 pls., 48 refs. Aargau, 1937.

This thesis records in detail field and laboratory observations on the development of *Hyalopterus arundinis*, F., mainly in the Swiss cantons of Zürich and Aargau.

Notes are given on the classification and synonymy of this Aphid, and on the more important literature from 1775 to 1935. *H. arundinis* is a migrant, its chief primary food-plants being species of *Prunus*. A list comprising apple (transitory infestation) and 20 species of *Prunus* covers the chief ones observed by the author, and 7 other records are cited from the literature. The more important in Switzerland were plum, damson, apricot and, to a less degree, sloe. The author found four secondary food-plants in Switzerland (the rush, *Phragmites communis*, being of almost exclusive importance), and 13 other records are cited from the literature.

The following is taken largely from the summary: *H. arundinis* hibernates only as a winter egg. Both on *Prunus* and on *Phragmites* the parthenogenetic generations die out in late autumn; only in a greenhouse with high temperatures and artificially stimulated *Prunus* could parthenogenetic reproduction be maintained until spring. For this reason, the first annual generation was formed exclusively by the fundatrices hatching in April from the winter eggs. The fundatrices gave rise to a series of parthenogenetic generations, the first of which comprised only wingless virgines that formed colonies on the leaves of *Prunus*. From the second generation onward, winged individuals also appeared. Those that occurred from May to early August in the colonies on *Prunus* were winged migrants, the progeny of which were able to develop and increase only on the secondary food-plant. In late summer and in autumn winged gynoparae were produced in the colonies on *Prunus* and remained there to give birth to oviparous females exclusively. No winged forms other than the migrants and gynoparae were produced on *Prunus*, but wingless virgines occurred (if young leaves were available) in eight or more generations up to late autumn. The first infestation of *Phragmites* in early summer by the winged migrants from *Prunus* began a series of

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parthenogenetic generations on the intermediate host. In these, a few winged virgines appear alongside the wingless virgines and fly from one rush plant to another. Later, winged gynoparae and winged males appear in the colonies on *Phragmites*, both being the re-migrants flying back to *Prunus*. The gynoparae produced on *Prunus* and those migrating from *Phragmites* behave alike, the offspring of both being solely the oviparous females with which the males pair. Unfertilised oviparous females can lay only infertile winter eggs. The change of food-plant is essential for the continuance of the species, because the males are produced only on the intermediate host. *H. arundinis* is therefore an obligatory migrant.

Further observations related to the differences in the number of the antennal sense organs in the winged forms, the occurrence of red individuals in the generations on *Phragmites*, the results of numerous experiments to ascertain the degree of susceptibility to infestation of various plants, and parasites and hyperparasites. Those recorded in the literature are noted. The author reared three parasites, *Aphelinus flavipes*, Först., and the Aphidiids, *Praon volucre*, Hal., and *Ephedrus lacertosus*, Hal., and three hyperparasites, a Pteromalid, *Asaphes vulgaris*, Wlk., and a Calliceratid, *Lygocerus giraudi*, Kieff., both from *E. lacertosus* and *P. volucre*, and a Cynipid, *Charips cameroni*, D.-T., from *P. volucre*.

LINKE (A.). **Doświadczenia nad zwalczaniem mszycy ogórkowej (*Doralis frangulae* Koch).—Streszczenie.** [Experiments in the Control of the Cucumber Aphid.—Abstract.]—*Roczn. Nauk rol.* **41** pp. 410–413. Poznań, 1937. (With a Summary in German.)

Following an outbreak of *Aphis gossypii*, Glov., which the author considers a synonym of *A.* (*Doralis*) *frangulae*, Koch, on cucumbers in greenhouses and frames near Poznan (western Poland) in 1935 and 1936, experiments on its control were carried out. The following measures were effective, did not injure the plants, and are recommended: spraying with 0·1 per cent. nicotine sulphate, or 2 per cent. soft soap containing not more than 6 per cent. potassium hydroxide; fumigation for 20 minutes with nicotine at the rate of 1½ oz. of 10 per cent. tobacco extract to 1,000 cu. ft. space in greenhouses, or of 3 oz. in frames, with subsequent thorough ventilation; and for older plants, fumigation throughout the night with calcium cyanide at the rate of ¼ oz. to 1,000 cu. ft. space in greenhouses, or of 0·37 oz. in frames, at temperatures not exceeding 20°C. [68°F.].

[Pests of Stored Products and Timber.]—*Verh. dtsch. Ges. angew. Ent.* **10** (1936) pp. 80–106. Berlin, 1937.

This series of papers includes a report by E. H. Bernfus on the use of hydrocyanic acid gas, ethylene oxide and Areginal in the municipal warehouses of the city of Vienna, a discussion by K. Andersen of the differences in the biology and ecology of store pests and field pests [*R.A.E.*, A **25** 267], and brief notes by Herfs on pests of woollen goods [**25** 206] and by various authors on *Calandra granaria*, L., and on *Hylotrupes bajulus*, L., attacking timber in houses in North Germany and now the subject of legislation [**24** 612]. Xylamon has proved effective against *H. bajulus* [**21** 323]. The basis of this

preparation is a liquid chlornaphthalene with a density of 1·25, a flash-point of over 120°C., and a burning point of about 200°C. It sets at −30°C. and boils between 250 and 280°C.

ESCHERICH (K.). **Die Zweiflügler (Diptera) des Waldes. Eine kurze Uebersicht.** [Forest Diptera. A brief Survey.]—*Forstwiss. Zbl.* 1937 no. 13–14 pp. 401–449, 27 figs. Berlin, 1937.

This survey is extracted from the section on Diptera in the fourth volume, in course of preparation, of the author's work on forest insects in Central Europe [*R.A.E.*, A **19** 372, etc.].

SCHNEIDER-ORELLI (O.). **Die Weisstannenlaus** *Dreyfusia nüsslini* **an alten Bäumen.** [The Silver Fir Aphid, *Chermes nordmannianae*, Eckstein, on old Trees.]—*Schweiz. Z. Forstwes.* 1937 no. 9, repr. 4 pp., 6 refs. Berne, 1937.

Severe infestation by *Chermes* (*Dreyfusia*) *nordmannianae*, Eckstein (*nüsslini*, Börner) of silver firs [*Abies*] 60 and 80 years old is recorded from Switzerland, where infestation of such old trees had not previously been observed. This Aphid has only been known to occur in central Europe for about 50 years [*cf. R.A.E.*, A **17** 639], and it is unlikely that 80-year-old trees had been attacked when young and had maintained the infestation. In Switzerland, foci of *C. nordmannianae* usually occur in inadequately shaded young plantations, and it is more probable that young larvae spread radially to old silver firs in the neighbourhood.

WIESMANN (R.). **Zur Diapause der Kirschfliege,** *Rhagoletis cerasi* **L. (Vorläufige Mitteilung.)** [Regarding the Diapause of the Cherry Fly, *R. cerasi*. (Preliminary Communication.)]—*Mitt. schweiz. ent. Ges.* **16** no. 12 pp. 727–729. Berne, 15th December 1936. [Recd. July 1937.]

Pupae of *Rhagoletis cerasi*, L, undergo a diapause [*R.A.E.*, A **21** 682] that persists even under optimum conditions of warmth. Under natural conditions in Switzerland in 1936, the diapause ended in March, having lasted 7 months. Winter frosts were not necessary to end it, long exposure to low temperatures above freezing point being sufficient. In attempts to interrupt it by external stimuli, a maximum emergence of 25 per cent. was obtained by immersing new pupae in water under conditions of warmth for a fairly long period. Later in the year, a higher rate of emergence was obtained by this method. Of various chemicals tested, a 1 per cent. solution of "CaOCl" acting for 4 days gave 100 per cent. emergence in January, but less in autumn.

BOVEY (P.). **Sur la biologie du carpocapse des prunes** (*Laspeyresia funebrana* **Tr.).**—*Mitt. schweiz. ent. Ges.* **16** no. 12 pp. 730–732. Berne, 15th December 1936. [Recd. July 1937.]

Observations in the Swiss cantons of Vaud and Valais showed that *Cydia* (*Laspeyresia*) *funebrana*, Treit., had 2 generations a year. The larvae in the overwintered cocoons, which are spun under the bark of the plum trees or any other suitable shelter, pupated at the end of March or in April, and the first flight was observed in May

and early June, with considerable variation from year to year. Females flew and oviposited at twilight, laying their eggs singly on the plum fruits, and only rarely on the leaves. Oviposition ceased when the average daily temperature fell below 14–15°C. [57·2–59°F.]. The egg stage lasted 9–18 days, and the larval stage 3–4 weeks. The infested fruits usually drop before the larvae leave them, and the larvae pupate at the base of the trunk or under any suitable cover on the ground. The fall of the fruits attracts little attention, as it occurs at the time of the normal physiological fall in June. The second flight of adults took place in July and August ; most of the eggs were laid in the second half of July and hatched in 6–9 days. The plums infested by second-generation larvae did not, as a rule, drop at once, but ripened more rapidly than uninfested ones. Although the two flights were quite distinct, the larval stages overlapped. The parasites bred from *C. funebrana* were the Ichneumonids, *Lissonota artemisiae*, Tschek, *Hemiteles inimicus* var. *longisetosus*, Schmied., *H. hemipterus*, F., *H. tricoloripes*, Schmied., *Angitia exareolata*, Ratz., and an undescribed species of *Ephialtes*, the Pteromalid, *Dibrachys cavus*, Wlk., and the Braconid, *Ascogaster quadridentata*, Wesm. All but the last species are new records for *C. funebrana*. *D. cavus* is a parasite of the larvae of *Cydia* and also of several of the other parasites.

Deshusses (J.) & Deshusses (L.). **Diptères nuisibles aux cultures, nouveaux pour la faune suisse ou peu connus.**—*Mitt. schweiz. ent. Ges.* **16** no. 12 pp. 740–749, 2 figs., 33 refs. Berne, 15th December 1936. [Recd. July 1937.]

Brief notes are given on the following Diptera observed in Switzerland during the last few years : *Hylemyia brunnescens*, Zett., on carnations ; *Merodon equestris*, F., and *Eumerus strigatus*, Fall., in bulbs of amaryllis ; *Phytomyza echinopsis*, Her., mining in the leaves of *Echinops humilis* ; *Ceratitis capitata*, Wied., which infested apricots near Geneva [*R.A.E.*, A **24** 360] ; and *Dasyneura schneideri*, Rübs., attacking *Arabis albida*.

[Ivanova (N. A.) & Nemiritzkiĭ (B. G.).] **Иванова (Н. А.) и Немирицкий (Б. Г.). The Estimation of Insecticides for Quarantine Treatment of living Plants against Scale-insects by Submersion in toxic Solutions.** [*In Russian.*]—*Plant Prot.* fasc. 12 pp. 129–135, 8 refs. Leningrad, 1937. (With a Summary in English.)

In experiments in Leningrad and Sukhum on the control of Coccids on nursery stock (chiefly *Citrus*), infested branches were immersed in water solutions of various insecticides. Those tested were pure anabasine and nicotine ; naphthenates of anabasine, nicotine, sodium and potassium ; sulphates of anabasine and nicotine ; and soaps of anabasine, nicotine or sodium prepared with fatty acids of dolphin blubber. None of the solutions caused complete mortality of the Coccids, even with concentrations of up to 0·5 per cent. of the alkaloid and an exposure of 60–90 minutes, at an average temperature of 20°C. [68°F.]. Heating the solutions to 45°C. [113°F.] gave a mortality of up to 100 per cent., but equal results are obtainable with hot water at 50°C. [122°F.] [*cf. R.A.E.*, A **24** 577]. Since, however, some plants do not survive exposure to hot water at 50°C., and as the

alkaloid soaps proved to be considerably more effective than any of the other solutions tested, further investigations on their application at 40–45°C. [104–113°C.] are recommended.

[Printz (Ya. I.).] **Принц (Я. И.). Zur Frage der Virulenzveränderung der Reblaus-Biotypen.** [Contribution to the Question of the Changes in the Virulence of *Phylloxera* of different Biotypes.] [*In Russian.*]—*Plant Prot.* fasc. 12 pp. 137–142, 2 refs. Leningrad, 1937. (With a Summary in German.)

Börner considers that the *Phylloxera* on vines can be divided into two basic biotypes, *vastatrix*, Planch., and *vitifoliae*, Fitch. [*cf. R.A.E.*, A **17** 306], which, according to his observations, form galls on the leaves and nodosities on the roots of the varieties Rupestris du Lot and Riparia × Rupestris 3309, respectively, neither being able to form galls on the variety preferred by the other. In experiments carried out in Transcaucasia in 1933 and 1934, however, individuals of *vastatrix* resulting from the eggs of females that had fed on Rupestris du Lot formed galls on Riparia × Rupestris 3309, while their offspring did not form any when transferred back to Rupestris du Lot, though they punctured the plants. In transfer experiments in which Rupestris du Lot was the only variety of vine used, galls were invariably produced. In other experiments, *vastatrix* did not form galls on Berlandieri × Riparia 5BB when transferred to it directly from Rupestris du Lot, but (contrary to Börner's theory) galls were invariably produced on it by the offspring of a generation that had fed on Riparia × Rupestris 3309.

In the case of *vitifoliae*, Börner's findings were fully confirmed, as individuals from Riparia × Rupestris 3309 failed to produce galls on Rupestris du Lot, but did so on Berlandieri × Riparia 5BB.

The existence of these two biotypes of *Phylloxera* in eastern Georgia and the greater virulence of *vastatrix* were also demonstrated in experiments in which three varieties of Transcaucasian vines were artificially infested with both forms, leaves with galls taken from Rupestris du Lot and Riparia × Rupestris 3309 being attached to plants grown in boxes. Examination of the roots in the autumn showed that those infested with *vastatrix* had a greater number of nodosities, which were also larger in size, than those infested with *vitifoliae*. Both biotypes produced galls on the leaves of two of the varieties used.

On the basis of these investigations, the author believes it possible to explain the appearance of galls on American seedlings in new districts. *Phylloxera* bred on European or Asiatic vines for 20–30 years loses the ability to form galls on American vines, and recovers it only after a protracted period of development on their roots. If, in an infested vineyard of American vines, galls appear within the first few years of planting, it shows that the *Phylloxera* involved had previously lived on American vines. If, however, galls only appear after 10–15 years, it shows that it had fed on European vines for a long time before infesting the American vines.

[Mamonov (B. A.).] **Мамонов (Б. А.). The Hessian Fly in northern Districts of Wheat Acclimatisation.** [*In Russian.*]—*Plant Prot.* fasc. 12 pp. 143–158, 1 map, 19 refs. Leningrad, 1937. (With a Summary in English.)

Detailed surveys in 1934 and 1935 of the distribution of the Hessian fly [*Mayetiola destructor*, Say] in the area north of the Black Soil Zone

showed that its importance in this part of European Russia has been underestimated. Infestation of winter and summer wheat was observed in 20 localities, 3 of which are considerably to the north of the boundary of distribution of the fly traced in previous investigations [*R.A.E.*, A **25** 268]. Moreover, the infestation causes greater damage than it does in the Ukraine and North Caucasus, as the plants are less resistant and are often killed, being unable to develop secondary shoots. Though meteorological conditions are the chief factor regulating the occurrence of the fly, the steady increase in the cultivation of winter and summer wheat in the north forms favourable conditions for its breeding; in some of the localities surveyed, the abundance of the fly in the infested fields was not less than that observed in the south of its area of distribution, where it is considered a dangerous pest.

[Shevchenko (M. N.).] **Шевченко (М. Н.). *Liriomyza cicerina* Rond. and its Importance to Cultivation of** *Cicer arietinum*. [*In Russian.*] —*Plant Prot.* fasc. 12 pp. 159–170, 6 figs., 12 refs. Leningrad, 1937. (With a Summary in English.)

Agromyza (*Liriomyza*) *cicerina*, Rond., caused considerable damage to chick-peas (*Cicer arietinum*) in different parts of the Ukraine in 1934. Its distribution and synonymy are briefly discussed and all stages are described. It had not less than four overlapping generations in southern Ukraine, and it hibernated in the pupal stage in the soil at a depth of 1–2 ins. In some localities up to 5,000 puparia occurred per sq. yard in August in fields in which chick-peas had been grown. The adults emerged in May; they feed on sap from the leaves of *C. arietinum*, which the females obtain by puncturing the leaves with the ovipositor. One leaf may have 3–28 punctures. The eggs are deposited singly or in pairs, the number in a leaf varying from 1 to 5. In southern Ukraine, the egg stage lasted 2–3 days, the larval 5–7, and the pupal 14–15. If the weather is unfavourable, the pupae may diapause; thus, in the laboratory, no flies had emerged by 1st October from pupae placed in test tubes on 1st August. The mines made by the larvae in the leaves cause them to turn yellow and fall, so that the plants are weakened. In 1934 the resulting loss of crop in southern Ukraine was 31 per cent. Moreover, the weakened plants are particularly liable to attack by the fungus, *Ascochyta*.

The soil should be loosened between the rows in summer to expose the pupae, and ploughed deeply after harvest to destroy them.

[Tzuigankov (S. K.).] **Цыганков (С. К.). Baiting as a Means for controlling Tenebrionidae injuring Cucurbits.** [*In Russian.*]—*Plant. Prot.* fasc. 12 pp. 181–184. Leningrad, 1937.

Observations in 1935–36 showed that cucurbits in the Province of Stalingrad were attacked by 10 species of Tenebrionids. *Opatrum sabulosum*, L., and *Dasus pusillus*, F., caused the most damage and constituted 75–80 per cent. of the Tenebrionid larvae collected. They were especially harmful to watermelons, as the injured plants almost invariably became infected with *Fusarium niveum*. The larvae often occur on the surface of the soil, and both larvae and adults shelter under lumps of earth, débris, etc. When heaps of freshly-mown but

dried grass, about 1 ft. high and 3 ft. in diameter, were placed at the edges of the plantations at the rate of one heap to 2½ acres, a great number of Tenebrionids and other insects concentrated under them in May, June and July, as well as lizards, frogs and spiders, which preyed on the insects. The trap-heaps should be placed in the plantations from early spring till late autumn, and the Tenebrionids collected daily. Poison baits of bran and sodium arsenite, at the rate of 3½ oz. per heap, which should be renewed every five days, may be substituted for the daily hand-collection of the beetles.

[Korab (I.).] **Кораб (И.). On the Measures of controlling** *Bruchus pisorum* **L.** [*In Russian.*]—*Plant Prot.* fasc. 12 pp. 184–185. Leningrad, 1937.

Experiments in 1934 by O. I. Petrukha in central Ukraine, the results of which are tabulated, showed that calcium cyanide is effective in destroying *Bruchus pisorum*, L., in peas in an air-tight container. Complete mortality of the Bruchid was obtained in 72 hours at an air temperature of 9°C. [48·2°F.] and 84 per cent. relative humidity by mixing 0·6 part calcium cyanide with 1,000 parts by weight of peas, and in 24 hours at 3°C. [37·4°F.] and 90 per cent. humidity with 0·9 part calcium cyanide. The germinating power of the peas was not impaired.

[Vasil'ev (I. V.).] **Васильев (И. В.).** Ed. **Notes on and Summaries of Reports of the Scientific Research Institutes of Plant Protection for the Year 1935.** [*In Russian.*]—*Plant Prot.* fasc. 12 pp. 187–191. Leningrad, 1937.

Of these summaries of unpublished reports by various authors, the following are of entomological interest:

Rumyantzev (M.). **Tests of chemical Control Measures against the Hemp Flea-beetle** (pp. 188–189). Of a number of dust insecticides tested against *Psylliodes attenuata*, Koch, on hemp in the Gor'kiĭ Province, sodium fluosilicate was the most effective and rapid in action. It was applied at the rate of 10–28 lb. per acre for seedlings, and 19–35 lb. for plants in the tassel stage. Calcium arsenate and anabasine dust were practically valueless.

Ruzaev (K.). **The Study of the Biology of the Mite** *Epitetranychus* **and its Control** (p. 189). In the Anapa district on the Black Sea coast of North Caucasus, *Tetranychus* (*Epitetranychus*) [*telarius*, L.] on vine hibernates under the loose bark of 2–4 year old shoots and only seldom in fallen leaves. In the severe winter of 1934, when the temperature fell to —27°C. [—16·6°F.], about 70 per cent. of the mites were killed by the cold. The best control in winter was obtained by smearing the stems and shoots with an 18 per cent. solution of bleaching powder, which killed 89·3 per cent. of the mites. In the summer, dusts of finely ground sulphur, containing from 16½ to 27 per cent. pure sulphur, gave 100 per cent. mortality; and sprays of lime-sulphur (0·25–0·5°Bé) gave 75–86 per cent.

Krasnyanskiĭ (A. I.). **Investigations on the Control of** *Otiorrhynchus turca*, **Boh.** (p. 189). Of insecticides tested against adults of *Otiorrhynchus turca*, Boh., on vines in the Anapa district, the only one that gave complete mortality was a dust of barium fluosilicate mixed with finely ground lime. Against the larvae in the soil, 72–78 per cent.

mortality was obtained with light applications (about 1 oz. per sq. yard) of paradichlorobenzene or calcium cyanide, and heavier applications (about 11 oz.) of polychlorides or sulphurous slag. It was found that fowls fed eagerly on the weevils and could almost eliminate them from infested plots.

Krasnyanskiĭ (A. I.). **Investigations on the Control of Cockchafer Larvae** (p. 190). In experiments in sandy vineyard soil on the sea-coast of the Anapa district, 75 per cent. mortality of Melolonthid larvae was obtained by applying paradichlorobenzene in holes 20 ins. apart and 12–16 ins. deep, at the rate of 10 gm. per hole. The vines were not injured. Polychlorides used at the same rate killed all the larvae, but affected the plants, in some cases causing the leaves to dry up and fall. Carbon bisulphide used at double the rate also killed all the larvae, and stimulated the growth of the vines.

Urmancheev & Sirazidinova. **The Estimation of the Effectiveness of the System of Control Measures against the Meadow Moth in Western Siberia** (p. 191). In the course of five years' investigations on the bionomics of *Loxostege sticticalis*, L., in the south of Western Siberia, breeding foci were found in the beet-growing area. In wet years, favourable conditions for the development and hibernation of the larvae occurred in the steppes. Spring and autumn ploughing to destroy the cocoons reduced the numbers of emerging adults by 68–71 per cent.

Gol'tzmaĭer. **Determination of the minimum Dosages of Poisons and Baits in overground Work against Acridids and of the technical Effectiveness of the Avio-method, together with the Estimation of their Species and Age and meteorological Conditions** (p. 191). Investigations during two years in the south-west of Western Siberia showed that baits broadcast by hand against Acridids are effective if the usual rate (14·4 lb. per acre) is halved. In the case of the younger hoppers, the usual concentration of 4 oz. sodium arsenite to 10 lb. horse dung may be reduced to 3 oz. provided that the sodium arsenite contains at least 65 per cent. arsenic. Broadcasting baits from aeroplanes killed 60–94 per cent. of the Acridids, and aeroplane dusting killed up to 95 per cent. Spring ploughing of land in which there were 22 egg-pods per sq. yard gave 80 per cent. control.

Jamalainen (E. A.) & Kanervo (V.). **Hedelmäpuiden ja marjapensaiden ruiskutukset kasvintuhoojien torjumiseksi** [The Spraying of Fruit Trees and Berry Bushes for the Control of Pests and Diseases].—*Maatalouss. Keskusl. Julk.* no. 254, 58 pp., 53 figs., 20 refs. Helsinki, 1937.

This guide for the owners of small orchards deals with the control of the common insect pests and diseases of fruit trees, bush-fruits and strawberries in Finland, and the different sprays and dusts to be used.

Massee (A. M.). **Notes on some interesting Mites and Insects observed on Fruit Trees in 1936.**—*Rep. E. Malling Res. Sta. 1936* **24** pp. 222–228. East Malling, Kent, May 1937.

Paratetranychus pilosus, C. & F. (*Olygonychus ulmi*, auct.) was abnormally abundant on fruit trees in south-eastern England from late

July onwards in 1936, and in some localities throughout the season. In one orchard, it persisted in spite of the application of three post-blossom lime-sulphur sprays. *Rhynchites aequatus*, L., infested small apples, plums and damsons severely, most of the damage being done by late June. Fruits appear to be punctured for oviposition, but actually few eggs have been found in them. Dusting with derris soon after petal-fall gives satisfactory control, though more than one application may sometimes be necessary. *Byturus tomentosus*, F., and *Atomaria linearis*, Steph., although pests of raspberries and mangels, respectively, are beneficial on apple, which they help to pollinate. *Clytus arietis*, L., was common in an apple orchard in Sussex where much dead wood was present; it has also been noted in the stems of plum trees. Larvae of *Prionus coriarius*, L., bored in the main roots of some old cherry trees; they normally attack a number of forest trees, including oak. *Aegeria* (*Conopia*) *tipuliformis*, Clerck, has been unusually common on currant bushes during the last 2 years. Wood-boring caterpillars of the goat moth [*Cossus cossus*, L.] and the leopard moth [*Zeuzera pyrina*, L.] have been more common on apple in the last few years. Branches tunnelled by them should be removed entirely, but if this is not desirable they may be extracted with flexible wire or killed by introducing a small piece of cyanide into the entrance of the gallery and plugging with clay. *Tortrix* (*Cacoecia*) *podana*, Scop., caused some damage to apples from July to September and was also observed on red and black currant and poplar. Several acres of black currants were destroyed by *Incurvaria* (*Lampronia*) *capitella*, Cl., which tunnels into the buds and shoots. *Cydia pomonella*, L., was not abundant during the year, although a severe infestation of apple was reported from one locality. The apple sawfly [*Hoplocampa testudinea*, Klug] and the plum sawfly [*H. flava*, L.] were observed ovipositing on blossoms in orchards where there had been no crop in the previous season. It is possible that some larvae wintering in the soil remained there for 2 seasons, or that the adults migrated from some other infested orchard. *Ametastegia glabrata*, Fall., which normally feeds upon dock, occasionally caused considerable damage by boring cylindrical holes in apples in which to hibernate. Numbers also hibernated in the dead portion of the spur growths that had been cut back the previous season. *Plesiocoris rugicollis*, Fall., which is one of the most important pests of apple in Kent, may be controlled by a spray of petroleum oil applied in late March. In one locality, the Pentatomid, *Sehirus bicolor*, L., was found feeding on plum foliage.

MASSEE (A. M.). **Studies on the Transmission of the Strawberry Virus "Yellow-edge" Disease by Insects. III. Aphid Transmission Experiments and Period of Infectibility.**—*Rep. E. Malling Res. Sta. 1936* **24** pp. 229–231. East Malling, Kent, May 1937.

Further experiments on "yellow-edge" disease of strawberries in Kent [*cf. R.A.E.*, A **24** 652, etc.] showed that *Capitophorus potentillae*, Wlk. (*fragaefolii*, Ckll.) was able to transmit it from diseased to healthy Royal Sovereign strawberry plants from March until August. After inoculation, the typical Aphid leaf-curl symptoms were first noticeable, followed by the "flattening" effect and finally the characteristic "yellow-edge" symptoms.

Massee (A. M.), Greenslade (R. M.) & Brair (J. H.). **Studies of Impregnation of Tree Banding Materials. III. Apple Blossom Weevil and Codling Moth Experiments in 1936. A Progress Report.** —*Rep. E. Malling Res. Sta.* 1936 **24** pp. 232–239, 13 refs. East Malling, Kent, May 1937.

A review is given of work carried out at East Malling from 1919 to 1936 on trap bands for the control of *Anthonomus pomorum*, L., and *Cydia pomonella*, L., on apple [*R.A.E.*, A **18** 503; **24** 652, etc.]. During 1936, tests were made of corrugated cardboard bands treated with 2 chlorinated naphthalenes (Seekay waxes) dissolved in different proportions of trichlorethylene, and β-naphthol in trichlorethylene, lubricating and cottonseed oils, and as a commercial band. None was so attractive to *A. pomorum* and *C. pomonella* as untreated bands, the results thus differing from those of the previous year [**24** 652]. It was estimated that the untreated bands caught nearly 50 per cent. of the larvae present on the trees. In an orchard that gave a good crop, counts of fallen fruit showed that the number of dropped fruits was more than twice the picked crop. The number of blossoms killed by weevils was therefore of no importance. It was noted, however, that weevil larvae were seldom found in the king bud, so that possibly the king apple is left at the expense of better fruit. In preliminary trials of bands impregnated with lorol thiocyanate (rhodanate), trichloro-phenol, α-chlor-β-naphthol, and β-chlor-α-naphthol, all the bands caused injury to the bark.

Shaw (H.). **Spray Residue Investigations. I. Determinations of Arsenic on Pears and Apples and of Copper on Loganberries.**— *Rep. E. Malling Res. Sta. 1936* **24** pp. 240–245, 11 refs. East Malling, Kent, May 1937.

The results are given of determinations of arsenic residues on apples and pears sprayed once with lead arsenate in England. The sprays were applied in late June, July or early August and the fruit was harvested on different dates between 30th July and 13th October. It is concluded that it is unsafe to apply the spray within 6 weeks of picking and that only the latest varieties can safely be sprayed up to mid-July. Actually, quantities of arsenical residue approaching the permissible limit are so visible as to render the fruit normally unsaleable. Determinations of the residue of copper left on loganberries showed that a combined wash containing an insecticide and a copper fungicide might safely be applied as late as 15 days before picking.

Shaw (H.) & Steer (W.). **Investigations on the Preparation of field-made Petroleum-oil Sprays. A Progress Report.**—*Rep. E. Malling Res. Sta. 1936* **24** pp. 246–249, 3 refs. East Malling, Kent, May 1937.

Laboratory and field trials were carried out in Kent to compare four proprietary emulsifiers with oleic acid and sodium hydroxide used by the two-solution method [*R.A.E.*, A **19** 612] for the preparation of petroleum oil sprays. It was found that 0·5 per cent. Whitcol J was satisfactory for sprays containing 3 per cent. oil, or as much as 6 per cent. oil when efficient power agitation was used. In the two-solution method, the quantity of oleic acid was successfully reduced to 0·15 per cent. and of sodium hydroxide to 0·0375 per cent.

STEER (W.). **Observations on Codling Moth (*Cydia pomonella* L.) in 1936.**—*Rep. E. Malling Res. Sta. 1936* **24** pp. 250–258, 4 figs., 1 ref. East Malling, Kent, May 1937.

Observations on *Cydia pomonella*, L., in Kent [*R.A.E.*, A **24** 742] were continued in 1936. Adults began to emerge in cages on 18th May, but, again, the majority emerged in June. None appeared at night. Day-to-day fluctuations in emergence were shown to be due to changes in temperature. There was no consistent connection between the date on which the larvae had left the fruit in the previous year and that on which the adults emerged. In the orchard, most of the moths emerged in June and some in July. Records of the incidence of eggs and larvae supported the theory that oviposition occurred chiefly during the few short periods in June and early July when the weather was warm and calm. Observations on eggs laid by females placed in muslin sleeves on apple shoots on various dates from 8th to 19th June showed that they can hatch in 7–10 days. Larvae usually entered apples through the side and pears through the calyx, though entry of apples through the calyx was more common than in 1935. Three adults emerged in August from larvae and pupae collected from sacking bands earlier in the month, and evidence of the occurrence of a partial second generation was obtained in the orchard, newly attacked apples and others containing small larvae being found on 12th and 24th September. Spraying trials, which were not conclusive, as infestation was very slight, indicated that the first cover spray of lead arsenate should be applied late in June. Where infestation is severe, lead arsenate should also be applied at petal-fall, and, on late varieties, towards the middle of July.

MOORE (M. H.) & MONTGOMERY (H. B. S.). **A Field Spraying Trial of Combined Fungicide-Insecticide Sprays in 1936.**—*Rep. E. Malling Res. Sta. 1936* **24** pp. 267–275, 1 fldg. table, 13 refs. East Malling, Kent, May 1937.

A detailed account is given of tests on apples of the fungicidal effects of four sprays (green-bud, pink-bud, petal-fall and three weeks after petal-fall) of lime-sulphur, lime-sulphur with "Lethalate," or Bordeaux mixture (2 : 10 : 100), with the addition of 0·4 per cent. lead arsenate paste in the first two applications, 0·05 per cent. nicotine in the third, and 1 per cent. oil also in the third in the case of Bordeaux mixture. In an appendix on the insecticidal effects of the sprays, W. Steer states that the nicotine controlled the apple sawfly [*Hoplocampa testudinea*, Klug] satisfactorily, whether the spreader was added or not. The lead arsenate gave inconclusive results against the codling moth [*Cydia pomonella*, L.].

STEER (W.). **The Control of Codling Moth. A Suggested Spray Programme.**—*Rep. E. Malling Res. Sta. 1936* **24** p. 302. East Malling, Kent, May 1937.

On the basis of recent experience in the control of the codling moth [*Cydia pomonella*, L.] in Kent, it is recommended that habitually heavily infested apple trees should receive a calyx spray of 4 lb. lead arsenate paste, 1 gal. lime-sulphur, 8 oz. nicotine and 100 gals. water at petal-fall, a first cover spray, similar except for the omission of nicotine, late in June, and a second cover spray in mid-July,

similar to the first for very late varieties, but with 2 lb. derris substituted for lead arsenate for others. When infestation is moderate, the first cover spray should be sufficient. The lime-sulphur is included in these sprays for the control of apple scab and red spider [*Paratetranychus pilosus*, C. & F.] and the nicotine against sawfly [*Hoplocampa testudinea*, Klug].

To control *C. pomonella* on pear, lead arsenate should be included in the second post-blossom spray against scab, care being taken that the calyx cup is well filled with spray.

SPEYER (E. R.). **Animal Pests.**—*Rep. exp. Res. Sta. Cheshunt* **22** (1936) pp. 70–78. Cheshunt, Herts., 1937.

In 1935 and 1936, the larvae of *Agromyza* (*Liriomyza*) *solani*, Macq., caused considerable injury to tomato plants in a nursery in Middlesex by mining the leaves. Mines were observed and many adults were present in tomato houses in May, but the maximum infestation arose from later generations in July–August. The pupal stage is passed at the extremity of the mine, but pupae are easily dislodged by shaking the branches. After larval feeding has ceased, the mines tend to heal. Many Braconid parasites were bred from the mines in late summer.

In further experiments against *Thrips tabaci*, Lind., on greenhouse carnations [*cf. R.A.E.*, A **24** 556], naphthalene, volatilised at the rate of 6 oz. per 1,000 cu. ft. over a period of at least 12 hours, killed all the larvae and most of the adults in the blooms. Three fumigations at weekly intervals gave complete control. In September, early October and May, no injury was caused to the plants by this process, but it is not considered advisable to fumigate carnations during the winter.

The mushroom shed at the Cheshunt research station was severely infested with Sciarids, which appeared in April and increased until early June, and Phorids of the genus *Megaselia* which appeared suddenly in early June. From random collections made in the shed in early June, it seemed that at the windows all the Sciarids and about 75 per cent. of the Phorids were females, whereas on the shelves the numbers of the sexes of Sciarids were about equal and male Phorids were nearly twice as numerous as females. Fumigation with nicotine shreds, even at the rate of 8 oz. shreds to 1,000 cu. ft., did not give control. Eggs and young larvae of the Phorids were present at the bases of mushroom stalks, and older larvae had tunnelled up the stalks into the caps. Pupae were found in the compost, but few in the casing soil. Sciarid larvae destroyed the pin-heads. *Tyroglyphus dimidiatus*, Herm. (*longior*, Gerv.) caused typical mite injury (large holes in the caps) to mushrooms in Worthing.

Experiments by W. H. Read on the control of red spider mite [*Tetranychus telarius*, L.] on carnations in January and February showed that effective fumigation with naphthalene is likely to cause severe injury. Sprays of an emulsified synthetic wax at a dilution of 1 : 100, or 1 : 140 with the addition of 0·1 per cent. of a proprietary synthetic wetter (Agral 2), killed the active stages of the mite and gave good control when applied twice at an interval of 7–10 days, but both mixtures slightly injured the flowers, and, if applied during bright weather, also frequently injured young foliage. O. B. Orchard and W. H. Read report that in early May a serious outbreak of *Thrips fuscipennis*, Hal., occurred on roses under glass at the experimental

station. The degree of malformation of the blooms and their infestation by immature stages of the thrips varied in different varieties. Promising results in experiments on control were obtained by frequent spraying with an oil emulsion containing nicotine, and also, after pruning for the last crop in autumn, by fumigation with hydrocyanic acid gas (⅔ oz. Cyanogas calcium cyanide per 1,000 cu. ft.).

Millepedes (*Blaniulus guttulatus*, Bosc, and *Orthomorpha gracilis*, Koch) attack the roots of cucumber in nurseries and have sometimes killed 50 per cent. of the plants. Dusting with naphthalene flakes and light spraying with nicotine only destroys those at the surface. In trials by O. B. Orchard, beds and borders were soaked late in the afternoon with water containing nicotine (1 : 2,000) and a wetting agent (1 fl. oz. Agral N to 8 gals.) at the rate of 1 gal. to 6 ft. length of border. The following morning the ground was thickly covered with millepedes ; 80 per cent. were dead, but the remainder recovered during the day and crawled back into the soil. In later tests, the survivors were killed by lightly spraying them with nicotine at the strength used for drenching, and experience in several nurseries showed that one treatment exterminated even heavy infestations. In a limited number of experiments, the application of naphthalene as a fine dust to the beds once a fortnight gave promising results, especially if they were watered immediately afterwards.

PARKIN (E. A.). **The Kiln-sterilization of Timber infested by *Lyctus* Powder-post Beetles.**—*Forestry* **11** no. 1 pp. 32–39, 7 refs. London, 1937.

The results of this investigation show that it is possible to use lower temperatures and relative humidities than have hitherto been recommended for the kiln-sterilisation of timber infested by *Lyctus* [*cf. R.A.E.*, A **17** 254 ; **24** 8, etc.]. Timber can be sterilised at a temperature as low as 105°F. and a relative humidity of 60 per cent., but it is recommended that, in practice, a temperature not lower than 115°F. should be employed. The work, which was carried out from December 1933 to January 1936, was confined to the winter months, so that half- or full-grown larvae should be present in the samples. Eggs, pupae and adults have all been found to be less resistant to heat than larvae. Samples of American ash, infested probably by *Lyctus planicollis*, Lec., were used when available, as this timber is easier to cut up for examination than English oak or French walnut, both attacked by *L. brunneus*, Steph. The technique of the experiments and the effects on *Lyctus* larvae in timber of varying exposures to different temperatures and relative humidities are described in detail.

A reduction in relative humidity necessitates a longer exposure to obtain 100 per cent. mortality. This was true for all temperatures except 110°F., where the lethal period was less at 60 per cent. humidity than at 80, In calculating the periods of exposure, allowance must be made for the time necessary for the heat to penetrate to the centre of the boards after the surface has come into approximate equilibrium with the atmosphere of the kiln [*cf.* 17 254]. Experiments showed that the lethal periods for *Lyctus* larvae at temperatures of 115, 120 and 125°F. are 30, 6 and 2 hours at 80 per cent. humidity, and 36, 7 and 4 hours at 60 per cent. Under the same conditions, and taking into account the time lag and safety factor, the periods

necessary for timber 1 inch thick, after the kiln has attained the required conditions, are 38, 8 and 3, and 45½, 9½ and 5½ hours, the time lag being ½ hour. At 130°F. and 100 per cent. humidity, the periods necessary for timber 1, 2, 2½ and 3 inches thick are 2½, 4, 5¼ and 6½ hours, the lethal period being 1½ hours and the safety factor ½ hour. Although a relative humidity of 100 per cent. helps to bring about the more rapid death of *Lyctus* larvae in wood, kiln-sterilisation at lower relative humidities is advantageous, because, provided that a suitable humidity is chosen, the timber does not change its moisture content by any appreciable amount even during long periods of exposure, nor does it suffer from surface wetting due to condensation.

Volkonsky (M.). **Sur un procédé nouveau de protection des cultures contre les acridiens.**—*C. R. Soc. Biol.* **125** no. 18 pp. 417–418. Paris, 1937.

Observations in Algeria have shown that *Melia azedarach* is not touched by locusts, and any cultivated plants can be made repellent to them by being sprayed with extracts prepared from its leaves. The active principal can be extracted with hot water, alcohol, chloroform or benzene [*cf. R.A.E.*, A **25** 159], but not with petroleum ether. The extract from 2 lb. dry leaves in 10 gals. water affords effective protection against *Schistocerca gregaria*, Forsk., but 2½ times this strength is required against *Dociostaurus maroccanus*, Thnb., *Calliptamus italicus*, L., and *Anacridium aegyptium*, L. The extracts are not poisonous to mammals and are unaffected by exposure to sun or rain. Concentrated extracts, which can later be diluted with water for spraying, are prepared by evaporating alcohol extracts to ⅕ of the weight of dry leaves used, and adding a small quantity of glycerine.

Volkonsky (M.). **Elevage et croissance larvaire du criquet égyptien (*Anacridium aegyptium* L.).**—*C. R. Soc. Biol.* **125** no. 21 pp. 739–742, 1 fig. Paris, 1937.

In breeding experiments in Algiers, *Anacridium aegyptium*, L., which normally passes through one generation a year, was induced to pass through two. Some individuals becoming adult at the end of August 1936, and placed in heated cages, oviposited by the end of December. The eggs were kept at an average temperature of 29°C. [84·2°F.] and hatched in 41–45 days; the hoppers, kept at temperatures averaging 22–23°C. [71·6–73·4°F.] and average humidities of 65–68 per cent., reached the winged stage by the end of March, and the resulting adults began ovipositing in early June. Isolated hoppers all passed through six instars, but in those kept crowded the males and females passed through five and six instars, respectively. Notes on the rate of growth of elytra and femora in the two sexes are included.

King (C. B. R.). **Report of the Entomologist for 1936.**—*Bull. Tea Res. Inst. Ceylon* no. 17 pp. 31–37. St. Coombs, Talawakelle [1937].

Work on the insect pests of tea in Ceylon during 1936 included preliminary investigations on the life-cycle of the shot-hole borer [*Xyleborus fornicatus*, Eichh.]. The egg, larval and pupal stages lasted about 4, 13 and 7 days, respectively. Larvae were most numerous in branches 14·5–16·5 mm. thick. The healing of the galleries was shown to be accelerated by the use of nitrogenous

manures [*cf. R.A.E.*, A **15** 210]. As in 1935 [**24** 633], infestation by nettle grubs [Limacodids] was less serious than for several years. Experiments suggest that spraying with a 1 per cent. soap solution may be an adequate method of control of *Helopeltis*, which caused some damage in one district in the early part of the year. Parasites introduced from Java [*cf.* **24** 633] for the control of the tea Tortrix [*Homona coffearia*, Nietn.] have become established in the field.

Cheo (Ming-tsang). **A preliminary List of the Insects and Arachnids injurious to economic Plants in China.**—*Peking nat. Hist. Bull.* **11** pt. 4 pp. 417–432. Peiping, June 1937.

This list, which is a continuation of previous ones [*R.A.E.*, A **25** 533, etc.], comprises 62 Lepidoptera, 56 Orthoptera, and 8 Thysanoptera and records the plants they attack and their distribution in China.

Nakayama (M.). **Studies on the Biology of *Spilonota lechriaspis* Meyr.** [*In Japanese.*]—*Ann. agric. Exp. Sta. Korea* **9** no. 1 pp. 70–85, 4 pls. Suigen, Korea, May 1937. (With a Summary in English.)

Descriptions are given of all stages of the moth, *Eucosma* (*Spilonota*) *lechriaspis*, Meyr., which infests apple, and to a less extent pear, on the western coast of Korea [*cf. R.A.E.*, A **20** 661]. This Tortricid has 1 or 2 generations annually, the moths occurring from June to August. The larvae spin together the leaves of the young shoots and retard the development of the new twigs ; they hibernate, usually in the fourth instar, in a similar shelter of dead leaves. Larvae that complete development in summer do so in 17–46 days. The egg stage lasts 4–6 days and the pupal stage 9–13. Adults live 6–7 days, and the females lay 10–79 eggs on the foliage at night. The larvae are parasitised by three undetermined Braconids. Collecting the spun leaves and spraying with lead arsenate or nicotine sulphate are recommended for control.

Nakayama (M.). **Notes on the Biology of *Monima lizetta* Butl.** [*In Japanese.*]—*Ann. agric. Exp. Sta. Korea* **9** no. 1 pp. 87–94, 1 pl. Suigen, Korea, May 1937.

The Noctuid, *Monima lizetta*, Btlr., all stages of which are described, and which infests apple in Korea, has one generation a year and overwinters in the pupal stage in the soil. The adults emerge in April, and their average longevity is 27 days. The average number of eggs laid by a female is 196, and the maximum 572 ; they are deposited in 2 or 3 masses on twigs during the night and hatch in 12 days. The larval stage lasts 24–44 days and there are 6 instars. Collecting the egg-masses and spraying with nicotine sulphate against the larvae are recommended for control.

Koidsumi (K.). **Experimental Studies on the Influence of low Temperatures upon the Development of Fruit-flies. Eighth Report. On the fatal Action of low Temperatures upon the Pupae of *Chaetodacus ferrugineus* var. *dorsalis* Hendel.** [*In Japanese.*]—*J. Soc. trop. Agric.* **9** no. 1 pp. 54–59. Taihoku, Formosa, April 1937.

In further experiments on *Dacus* (*Chaetodacus*) *dorsalis*, Hend., in Formosa [*cf. R.A.E.*, A **25** 227], pupae bred at 20–30°C. [68–86°F.]

were exposed to constant temperatures between —6°C. [21·2°F.] and 9°C. [48·2°F.]. There was very little difference in resistance to cold during the pupal period, though the pupae appeared to be most resistant just before the emergence of the adults. Resistance was usually greater in winter than in summer, though few pupae developed below 9°C. at any season. All the pupae were killed in 10 hours at — 6°C. [21·2°F,], 44 hours at — 3°C. [26·6°F.], 5 days at 0°C. [32°F.] 12 days at 3°C. [37·4°F.], or 20 days at 6°C. [42·8°F.].

KUWAYAMA (S.). **Chafers, or Scarabaeid Beetles, and their Relation to Agriculture.** [*In Japanese.*]—*Bull. Hokkaido agric. Exp. Sta.* no. 61, 73 pp., 5 pls., 33 figs. Sapporo, March 1937.

Descriptions are given of all stages of seven Lamellicorns that are injurious in Hokkaido, with notes on their bionomics and instances of the injury they have been observed to cause. The species that attack fruit trees and other crops in the adult stage are *Aserica* (*Serica*) *orientalis*, Motsch., *Popillia japonica*, Newm., *Anomala rufocuprea*, Motsch., *A. geniculata*, Motsch., and *A. cuprea*, Hope. The adults of *Mimela* (*Anomala*) *testaceipes*, Motsch., feed chiefly on larch, but the larvae are very injurious to the roots of cereals and vegetables, which are also attacked by those of *A. rufocuprea* and *A. geniculata*. Larvae of *Heptophylla picea*, Motsch., have been observed to injure young spruce trees ; the adults occasionally feed on rice, but have not been found on other cultivated plants. *H. picea* completes its life-cycle in a year, whereas the species of *Anomala* require two or three years for development. Natural enemies of these Lamellicorns include various birds, the Tachinid, *Centeter cinerea*, Aldr., and the Asilid, *Promachus yesonicus*, Big.

Other subterranean insects attacking cultivated plants in Hokkaido include *Bourletiella hortensis*, Fitch (*pruinosa*, Tullb.) on young crucifers, cucurbits and beet, *Gryllotalpa africana*, P. de B., on potato and wheat, *Hylemyia* (*Chortophila*) *flavopicta*, Mats., on radish and other cruciferous vegetables, *Phorbia* (*C.*) *cilicrura*, Rond., on beans and wheat, *Corymbites puncticollis*, Motsch., on beet and beans, and *Agriotes fuscicollis*, Miwa, on cereals and potato.

YANO (M.). **Insect Pests of** *Paulownia tomentosa*. [*In Japanese.*]—*Ringyo Sosho* no. 4 pp. 15–32, 7 pls. Tokyo, Minist. Agric. & For., Bur. For., 1936. [Recd. August 1937.]

Brief descriptions are given of 13 insects that infest *Paulownia tomentosa* near Tokyo. The trees are sometimes severely attacked by wood-borers, including the Hepialid, *Phassus excrescens*, Btlr., and the Lamiid, *Batocera lineolata*, Chevr. The larvae of *P. excrescens* are polyphagous and apparently migrate to *Paulownia* and other trees when partly grown, having previously fed on lily, dahlia and weeds. The adults emerge from August to October, and the female lays about 5,000 eggs. *B. lineolata* has one generation a year, the adults emerging from June to August. It also attacks oak, willow, etc. The Prionid, *Megopis sinica*, White, oviposits in places injured by *P. excrescens*, and the larvae feed on the dead parts, causing the timber to decay.

YAMAZAKI (T.). **On the Life-history of** *Synonycha grandis* **Thunb.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **9** no. 2 pp. 93–99, 1 fig. Tokyo, April 1937.

A study of the Coccinellid, *Synonycha grandis*, Thnb., was carried out in the Loochoo Islands, where it is of importance as a natural enemy of *Oregma* (*Ceratovacuna*) *lanigera*, Zehnt., on sugar-cane. The females begin to oviposit a day after pairing and lay a total of some 440 eggs in 12–20 batches, usually on the lower surface of the leaves of the sugar-cane. The egg, larval and pupal stages last 5, 8–15 and 5 days, respectively, and the adults appear to live for more than 2 months.

UCHIDA (T.) & OKADA (I.). **On the Relation between the Oviposition of** *Grapholitha glycinivorella* **Mats. and the Number of Hairs on Soy Bean Pods.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **9** no. 2 pp. 100–104. Tokyo, April 1937.

Cydia (*Grapholitha*) *glycinivorella*, Mats., is a serious pest of soy beans in Hokkaido and Manchuria. Observations in the latter country showed that the rate of infestation differs with the variety, because the moths prefer to oviposit on the more hairy pods and lay no eggs on pods that are hairless.

MORI (N.). **On** *Phytodecta rubripennis*, **Baly.** [*In Japanese.*]—*Nojikairyo-Shiryo* no. 121 pp. 19–20. Tokyo, 1937.

Descriptions are given of all stages of the Chrysomelid, *Phytodecta rubripennis*, Baly, which feeds on *Wistaria* in Japan. It appears to have one generation a year. The adults hibernate and oviposit on the young leaves in May, and the eggs hatch in early June. The larvae feed on the leaves, mature in 10–12 days and pupate in the soil, the pupal stage lasting 5 days.

MURAKAMI (S.). **On** *Galerucella tibialis*, **Baly.** [*In Japanese.*]—*Nojikairyo-Shiryo* no. 121 pp. 27–29, 1 fig. Tokyo, 1937.

Descriptions are given of all stages of the Galerucid, *Galerucella tibialis*, Baly, the larvae and adults of which feed on the leaves of *Celtis sinensis* in Japan. The eggs are laid under the bark of twigs, generally where they fork, in early July, and hatch in mid- and late April of the following year. The larvae mature in a month, and the prepupal and pupal stages, which are passed in the soil, last a month and 7–10 days, respectively. The adults, which live for 3–4 months, pair 10–14 days after emergence, and the females begin to oviposit 4–5 days later.

NAWA (U.). **On the Control Methods of** *Baris deplanata* **Roelf.** [*In Japanese.*]—*Insect World* **41** no. 5 pp. 186–188. Gifu, May 1937.

Baris deplanata, Roel., causes serious injury to mulberry in Japan. The adult weevils begin to feed on the buds in April and lay eggs singly in the branches near them. The larvae, which hatch in 7–10 days, bore under the bark and pupate after about 2 months. The adults emerge a fortnight later but remain in the mines until next spring. Collecting the adults and removing infested branches are recommended for control. Sprays of lime-sulphur or lime and lead arsenate prevent attack by the adults.

Ono (K.). **On the Insect Pests of Persimmon.** [*In Japanese.*]—*Insect World* **41** no. 5 pp. 195–199. Gifu, May 1937.

Brief notes are given on 11 insects that attack persimmon (*Diospyros kaki*) in Japan. They include *Kakivoria flavofasciata*, Nagano, *Blenina senex*, Btlr., *Monema* (*Cnidocampa*) *flavescens*, Wlk., *Clania minuscula*, Btlr., *Percnia giraffata*, Gn., *Dichocrocis punctiferalis*, Gn., and *Sinoxylon japonicum*, Lesne.

Shigehara (K.). *Udea ferrugalis*, **Hbn., a Pest of** *Capsicum annuum*. [*In Japanese.*]—*Insect World* **41** no. 6 pp. 216–221. Gifu, June 1937.

Capsicum annuum in a greenhouse in the Shiga Prefecture has recently been heavily infested by the Pyralid, *Phlyctaenia* (*Udea*) *errugalis*, Hb., all stages of which are described. The injury was most severe in late February. The moths flew about the greenhouse in the daytime and oviposited on the lower surface of the leaves, especially on the young ones.

Koitabashi (H.). **On the Biology of** *Aglossa dimidiata* **Haworth, a Pest of Stored Rice.** [*In Japanese.*]—*Insect World* **41** no. 7 pp. 258–260. Gifu, July 1937.

In Japan, the larvae of *Aglossa dimidiata*, Haw., infest various stored products, including rice. They are most active from August to October, moult 4–5 times and hibernate. The moths emerge in June, and there seems to be one generation a year.

Tamaru (I.). **Notes on the Injuries caused by some Insect Pests of Field Crops.** [*In Japanese.*]—*J. Plant Prot.* **24** no. 5 pp. 332–340. Tokyo, May 1937.

Brief notes are given on some insect pests observed in the Ibaragi Prefecture, near Tokyo, in 1936. They include *Anomala rufocuprea*, Motsch., *Epicauta gorhami*, Mars., and the Sphingid, *Clanis bilineata*, Wlk., on soy beans ; *Aserica* (*Autoserica*) *japonica*, Motsch., on various beans and *Sesamum* ; *Monolepta nigrobilineata*, Motsch., on beans and rice ; *Chaetocnema cylindrica*, Baly, on wheat ; *Psilogramma increta*, Wlk., on *Sesamum* ; and *Nezara antennata*, Scott, on beans and rice.

Kono (T.). **Experiments with Chlorpicrin Fumigation against Stored Grain Pests.** [*In Japanese.*]—*J. Plant Prot.* **24** no. 7 pp. 520–529, 1 fig. Tokyo, July 1937.

The results are given of experiments in Japan on the control of *Calandra oryzae*, L., in stored rice by fumigation with chloropicrin. At 30°C. [86°F.], all larvae and pupae were killed in 3 hours by chloropicrin applied at the rate of 1 lb. per 1,000 cu. ft. air, and adults and eggs were all killed in less than an hour. At 15°C. [59°F.], exposure of larvae and pupae for 7 hours and adults for 3 hours did not give complete mortality. It is doubtful whether older larvae are more resistant than young ones, but the degree to which the larvae are sheltered within the rice grains is an important factor in the effectiveness of the fumigant. The low resistance of the eggs may be due to the fact that they are deposited on the surface of the grains and are therefore more exposed.

MORI (N.). **On the Importation of Plant Diseases, injurious Insects and prohibited Plants.** [*In Japanese.*]—*Kontyû* **11** no. 4 pp. 305–309. Tokyo, July 1937.

An account is given of the legislation to prevent the importation of injurious insects, etc., into Japan.

KONO (H.). **Eine neue** *Baris*-**Art als Schädling an** *Mentha arvensis* [A new species of *Baris* as a Pest of *M. arvensis*].—*Kontyû* **11** no. 4 p. 316, Tokyo, July 1937.

YUASA (H.). **Scientific Names of Weevils attacking Peppermint.** [*In Japanese.*]—*T.c.* p. 328. Tokyo, July 1937.

The larvae of *Baris pilosa*, Roel., and *B. menthae*, sp. n. (described in the first paper) bore in the stalks of Japanese peppermint [a variety of *Mentha arvensis*] in Okayama Prefecture, Japan. The eggs are found in the stalks at ground level.

TAKEI (S.) & TADA (K.). **On new Insecticides against Insect Pests of Wool.** [*In Japanese.*]—*Bochu Kagaku* no. 1 pp. 3–8. Kyoto, June 1937.

This is a discussion on the use of insecticides against insect pests of woollen goods. Pyrethrum and rotenone are both effective, but the latter at the rate of 3 parts to 1,000 by weight of material is preferable for preventing infestation, as the former evaporates more quickly.

YAMADA (Y.). **On the Insect Pests of Woollen Goods.** [*In Japanese.*]—*Bochu Kagaku* no. 1 pp. 9–14, 8 pls., 2 figs. Kyoto, June 1937.

In Japan, about 20 insects are known to injure woollen goods, of which the most important are *Anthrenus verbasci*, L., *Attagenus japonicus*, Reitt., *Tinea pellionella*, L., and *Tineola biselliella*, Humm. *A. verbasci*, all stages of which are described and which is commoner in southern than in northern Japan, has one generation a year and overwinters in the larval stage. Pupation takes place in late April and early May, and the adults emerge 2 weeks later. They feed on the pollen of wild flowers [*cf. R.A.E.*, A **24** 123] and remain at the base of the flowers at night. The eggs are laid singly on woollen goods in houses and hatch in 7–10 days. The larvae are most injurious from June to early October, and hibernate from early November. Clothes treated with rotenone (1 oz. to 25 lb. cloth weight) are not attacked.

SHIRAKI (T.). *Schoenobius incertellus* **Walk.** [*In Japanese.*]—*Agric. & Hort.* **12** nos. 2–4 pp. 599–606, 854–860, 1130–1138, 14 figs. Tokyo, 1937.

This is a summary of the results of the author's studies, published 20 years ago [*R.A.E.*, A **5** 574], on *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) attacking rice in Formosa.

KAWAGUCHI (M.). **Dropping of Persimmon Fruits and Control of** *Kakivoria flavofasciata* **Nagano.** [*In Japanese.*]—*Agric. & Hort.* **12** no. 5 pp. 1467–1470, 3 figs. Tokyo, May 1937.

In Japan, the fruits of persimmon are infested by *Kakivoria flavofasciata*, Nagano, which causes them to fall, from mid-June to October.

Sprays of lead arsenate, which was more effective with lime than with Bordeaux mixture, applied 2 or 3 times from mid-June to early July and again from late July to mid-August, gave fair control.

MATSUBARA (S.). **The Injuriousness and Control of** *Cryptodactylus gracilis* **Schönf., a Pest of Chestnut Trees.** [*In Japanese.*]—*Agric. & Hort.* **12** no. 7 pp. 1921–1924, 3 figs. Tokyo, July 1937.

A brief account is given of the bionomics of the Buprestid, *Cryptodactylus gracilis*, Schoenf., which is widely distributed on chestnut in Japan [*R.A.E.*, A **23** 132]. It also attacks *Citrus*, oaks and *Pasania*. From 16 to 19 larvae are sometimes found in a single branch of chestnut, and smaller trees with dense growth seem to be more affected than others. Measures recommended for control include collecting the beetles on the leaves in the early morning, spraying the trees with lead arsenate, pyrethrum-soap, or neoton (a preparation of derris), covering the young branches with whitewash, and cutting off those infested.

SAWADA (E.). **Methods of Cyanic Fumigation of** *Citrus* **in Summer.** [*In Japanese.*]—*Agric. & Hort.* **12** no. 7 pp. 1925–1935, 2 figs. Tokyo, July 1937.

In the Nagasaki Prefecture, *Prontaspis yanonensis*, Kuw., and *Ceroplastes rubens*, Mask., are serious pests of *Citrus*, but in recent years the injury has been decreased by fumigating the trees in summer with hydrocyanic acid gas. The best formula is 170–200 gm. sodium cyanide (74 per cent.), 170–200 cc. sulphuric acid and 510–600 cc. water per 1,000 cu. ft., with an exposure (in July–August) of 20–30 minutes between 3 and 8 p.m. Fumigation is more effective at high temperatures and against insects on the upper branches. It improves the colour of the fruit, but sometimes injures young plants.

UYE (T.). **On** *Toxoptera piricola* **Mats.** [*In Japanese.*]—*Ent. World* **5** no. 41 pp. 452–460, 2 figs. Tokyo, 1937.

In Japan, the fundatrices of *Toxoptera piricola*, Mats., all stages of which are described, hatch from the overwintered eggs on pear trees in late March. Winged forms appear in the second and following generations and migrate to *Cyperus malaccensis*. From June to September, no Aphids are found on pear trees and several generations, mostly of apterae, develop on *Cyperus*. The sexuparae begin to return to pear in October and the males in November.

YUASA (H.) & KUMASAWA (T.). **Distribution and Food Plants of** *Asphondylia* **sp., a Pest of Soy Bean.** [*In Japanese.*]—*Bot. & Zool.* **5** no. 8 pp. 1561–1562. Tokyo, August 1937.

Asphondylia sp. is widely distributed on soy beans in Japan and also attacks a number of other leguminous plants, including *Cassia mimosoides, Desmodium podocarpum, Lespedeza bicolor* and *Indigofera pseudotinctoria*.

Taylor (G. C.). **Application of Orchard Sprays. III. Spray Nozzles.**—*N.Z.J. Agric.* **53** no. 2 pp. 68–76, 17 figs., 6 refs. Wellington [N.Z.], August 1936. *Op. cit.* **54** no. 2 pp. 71–74, 5 figs. February 1937; no. 5 pp. 267–274, 6 figs. May 1937.

This paper, which is one of a series on the use of spraying equipment in orchards in New Zealand [*R.A.E.*, A **24** 439], describes different types of nozzles and the way in which they affect the angle of the spray cone, the distribution and fineness of the spray droplets, volume delivery and depth of penetration.

Tonnoir (A. L.). **The biological Control of the Greenhouse White Fly in Australia.**—*J. Coun. sci. industr. Res. Aust.* **10** no. 2 pp. 89–95, 3 pls., 2 refs. Melbourne, May 1937.

The appearance, habits and distribution of *Trialeurodes vaporariorum*, Westw. [*R.A.E.*, A **10** 284] are briefly described. In Australia, it infests tomatos in greenhouses, but is also able to overwinter in the egg and adult stages and spread out of doors. Breeding may continue in the open until the first frosty mornings. Eggs are laid at random on the underside of the youngest leaves. Some females have been observed to lay more than 500. The progeny of unfertilised females are all males. There are 4 larval instars; the first-instar larva can move from one part of the leaf to another, but does not migrate from plant to plant.

The history of the Aphelinid, *Encarsia formosa*, Gah. [**15** 240] and of attempts, eventually successful, to introduce it into Australia and New Zealand [**23** 397; **24** 3, 378; **25** 321, etc.] is briefly reviewed. Females may lay 100 eggs. The life-cycle has occasionally been observed to be as short as 20 days. *Encarsia* can live through the fairly mild Australian winter in the open and has survived several weeks of storage at 40–45°F. Its establishment in New South Wales, Victoria and Tasmania and its recent introduction into South Australia, where it had been reared and distribution has begun, are recorded.

Miller (D.). **Insect Fauna and the Development of Economic Entomology in New Zealand.**—*Handb. Auckland Meet. Aust. N.Z. Ass. Adv. Sci.* pp. 67–70. Wellington, N.Z., 1937.

This paper comprises a brief discussion of the chief families of introduced and native insects in New Zealand, and an account of the development of economic entomology there.

P[into] da Fonseca (J.). **A "Escama Vermelha." Uma perigosa praga dos Citrus.** [The Red Scale, a dangerous Pest of *Citrus*.]—*O Biologico* **3** no. 7 pp. 195–200, 1 fig. S. Paulo, July 1937.

The red scale, *Aonidiella aurantii*, Mask., is recorded from *Citrus* in the State of S. Paulo, Brazil, in which country it had previously been observed, but only on roses [*cf. R.A.E.*, A **25** 77]. Notes on its bionomics and control are given from the literature.

Townsend (C. H. T.). **New Fly Parasites of** *Dysdercus*.—*Rev. Ent.* **7** fasc. 2–3 pp. 316–318. Rio de Janeiro, 24th July 1937.

Descriptions are given of four new species of flies, *Acaulona brasiliana*, *Euomogenia dysderci*, *Paraphorantha brasiliana*, and *P. dimidiata*, all reared from cotton stainers (*Dysdercus*) in São Paulo, Brazil.

Muesebeck (C. F. W.). **A new West Indian Species of** *Mirax* **Haliday parasitic on the Coffee Leaf-miner (Hymenoptera : Braconidae).**—*Proc. ent. Soc. Wash.* **39** no. 6 pp. 139–141, 1 fig., 2 refs. Washington, D.C., June 1937.

Descriptions are given of both sexes of *Mirax insularis*, sp. n., reared from *Leucoptera coffeella*, Guér., on coffee in Guadeloupe and Dominica. This species, which is the first of its genus to be recorded from the West Indies, is compared with the African species *M. leucopterae*, Wlkn. [*R.A.E.*, A **25** 74].

Wheeler (N. H.). **Trap-light Studies on Leafhoppers belonging to the Genus** *Empoasca* **(Homoptera : Cicadellidae), with the Description of two new Species.**—*Proc. ent. Soc. Wash.* **39** no. 6 pp. 141–156, 4 figs., 11 refs. Washington, D.C., June 1937.

During the summers of 1932–35, two light-traps (which are described) were operated each day, generally from dusk to dawn, at Arlington, Virginia, with the object of collecting leafhoppers of the genus *Empoasca*. In collections of 100 or less, all the males were identified as to species, and in larger collections 100 males were selected at random. During the period of greatest abundance (July and August), the males far outnumbered the females in the collections, but in the fields the proportion of the sexes was reversed. In all, 28 species were obtained during the 4 seasons, including 5 new species, 2 of which are described in this paper. From 11,928 specific determinations made from internal male genitalia, the most common were *E. fabae*, Harr. (10,102), *E. erigeron*, DeLong (1,106), *E. pergandei*, Gill. (189), and *E. solana*, DeLong (142). *E. fabae* and *E. erigeron* occurred throughout the season. The occurrence of the first large collections of *E. fabae* in the traps was correlated with the maturing of a large brood of adults on oak and hickory in the neighbourhood [*R.A.E.*, A **24** 181].

Brunson (M. H.). **The Influence of the Instars of Host Larvae on the Sex of the Progeny of** *Tiphia popilliavora* **Roh.**—*Science* **86** no. 2226 p. 197. New York, 27th August 1937.

Studies on the interrelation between the larval instars of *Popillia japonica*, Newm., and its Scoliid parasite, *Tiphia popilliavora*, Rohw., showed that the female parasite could control the sex of its offspring at the time of oviposition, the stimulus being definitely associated with the instar or size of the host. The larvae of *P. japonica* have three instars, which differ considerably in average size. The parasite attacks the second and third instars and development is completed in each of them, though the third instar is preferred. In a number of observations in which fertile female parasites were offered both second- and third-instar larvae simultaneously, second or third exclusively

and second and third on alternate days the resultant progeny were predominantly males from the parasitised second-instar larvae, while a normal sex ratio consisting of slightly more females than males resulted from third-instar larvae. Proof that the female can vary the sex of its offspring at the time of parasitisation of larvae of different instars was obtained when eggs laid by the parasites on second-instar larvae were transferred to third-instar larvae and *vice versa*. The resultant progeny were still predominantly males in the first case and showed a normal ratio of males and females in the second.

Kunkel (L. O.). **Effect of Heat on Ability of** *Cicadula sexnotata* **(Fall.) to transmit Aster Yellows.**—*Amer. J. Bot.* **24** no. 5 pp. 316–327, 3 figs., 6 refs. Lancaster, Pa, May 1937.

The following is taken from the author's summary of experiments on the effect of heat on the virus of aster yellows in the insect vector, *Cicadula sexnotata*, Fall. Infective colonies of the leafhopper subjected to 31–32°C. [87·8–89·6°F.] for 12 days or longer lost permanently their ability to transmit the disease. Colonies exposed for 1–11 days were able to transmit the virus after periods varying (with the length of exposure) from a few hours to many days. Colonies in which virus was undergoing natural incubation were more affected by heat than those that were infective at the time of treatment. It is concluded that long exposure to heat causes inactivation of all the virus carried by infective insects and that short treatment produces inactivation of a part only. The time required for insects to regain infectivity is regarded as a heat-induced incubation period during which that part of the virus not inactivated by the treatment multiplies sufficiently to render the insects infective. After heat treatments, viruliferous colonies frequently transmitted mild strains of the virus, and 3 such strains remained unchanged on passage from plant to plant, suggesting that heat exerts some kind of selective action on the strains. The rate of spread of aster yellows in a field plot was found to reach its highest point late in the season, when plants were relatively resistant to infection because they were nearing maturity and when insects were less numerous than in midsummer. The temperatures of midsummer may inactivate much of the virus carried by leafhoppers at this season, which may account for the late seasonal rise in rate of spread.

Howard (N. F.) & Mason (H. C.). **Results of experimental Work with Rotenone-bearing Materials for the Control of Vegetable Insects.**—*Proc. Ohio Veg. Grow. Ass.* **22** pp. 19–24. Columbus, Ohio, 1937.

Experiments carried out in the United States in the last few years on the value of derris and cubé [*Lonchocarpus*] in dusts and sprays against insect pests of vegetable crops are briefly discussed, and formulae are given for calculating the amount of derris of any given rotenone content required to obtain a desired percentage of rotenone in 50 U.S. gals. spray or 100 lb. dust. A dust containing 0·75 per cent. rotenone is the most effective for general use in vegetable gardens.

Bailey (S. F.). **The Composite Thrips,** *Microcephalothrips abdominalis* **(Crawford).**—*Canad. Ent.* **49** no. 6 pp. 121–126, 2 figs. Orillia, June 1937.

The synonymy, characters, distribution and food-plants of *Thrips* (*Microcephalothrips*) *abdominalis*, Crwf., are discussed. During late

summer and autumn, this cosmopolitan thrips is common in California in flowers of *Zinnia*, marigold and *Calendula* and occasionally causes some slight damage to thin-coated seeds. The entire life-cycle is passed in the flower heads. Eggs are inserted in the tender parts of flower, stem or bud, and probably hatch in about 5 days. In early autumn, the larval stage lasted 2 weeks. The prepupal and pupal stages lasted 1–2 and 2–3 days, respectively. Pupae have been observed up to 25th November, and adults and larvae throughout the winter. In central California, one generation is prolonged from late autumn until early spring, but there is much overlapping of generations in the summer. The greatest seasonal abundance is in early autumn, when males become quite common. *Orius tristicolor*, White, is predacious on this thrips.

WALLEY (G. S.). **The Genus *Smicroplectrus* in Canada (Hymen. : Ichneumonidae).**—*Canad. Ent.* **49** no. 6 pp. 131–136. Orillia, June 1937.

A key is given to the Canadian species of *Smicroplectrus*, together with the characters distinguishing *S. californicus*, Cress., the only other known American species of the genus. Three new species are described from material in the Canadian National Museum, including *S. velox*, reared from *Pachynematus ocreatus*, Harrington, on spruce in Ontario, and notes are given on the other five Canadian species, one of which has not been named, as only a single male is available.

WOODRUFF (L. C.). **A Grasshopper Survey for eastern Kansas, 1936.**—*J. Kans. ent. Soc.* **10** no. 3 pp. 75–83, 2 refs. McPherson, Kans., July 1937.

During the season of 1936, grasshoppers were very abundant in Kansas and elsewhere in the plains region of the United States, and although there were no extensive flights or mass migrations, they caused serious injury. Of the adult grasshoppers collected by net-sweeps made three times a week in July–August in a lucerne field, a maize field, a weed patch and a plot of original prairie, *Melanoplus femur-rubrum*, DeG., represented 51·5 per cent., and *M. differentialis*, Thomas, *M. mexicanus*, Sauss., and *M. bivittatus*, Say, together represented 34·6 per cent. *M. femur-rubrum* was the dominant species in the lucerne field, where the grasshopper population was greatest, but *M. differentialis* and *M. bivittatus* were universally prevalent and injurious, and were probably more abundant than appeared. *M. mexicanus* was of only minor importance, and its ph. *gregaria* (*spretus*, Walsh) [*cf. R.A.E.*, A **21** 472] did not make its appearance. On the prairie plot, *Melanoplus* spp. were no more abundant than other grasshoppers, and several species were present that were rare elsewhere.

JEFFS (H. B.). **Emploi de l'arsenic pour la destruction des sauterelles au Canada.**—*Bull. Off. int. Hyg. publ.* **29** fasc. 5 pp. 963–965. Paris, May 1937.

The organisation of grasshopper control in Canada is briefly described. The principal measure is the use of poison baits consisting of 5 lb. white arsenic or Paris green mixed with 55 lb. bran, 55 lb. sawdust, 4 lb. salt and 10 gals. water, or with 100 lb. horse-dung, 2 lb. salt

and sufficient water to moisten the mixture. The baits should be distributed at the rate of 25 lb. to 4 acres, preferably when the temperature is about 75°F. They constitute no danger to stock when spread uniformly and thinly.

PARKER (J. R.). **Intoxication par l'arsenic chez l'homme et les animaux à la suite des campagnes de destruction des sauterelles.** — *Bull. Off. int. Hyg. publ.* **29** fasc. 5 pp. 966–971. Paris, May 1937.

In the United States, very large quantities of arsenical baits are employed during years of grasshopper outbreaks. The baits are made of 5 lb. crude arsenic containing 90 per cent. arsenic trioxide, or 2 U.S. quarts of sodium arsenite solution containing 32 per cent. to 100 lb. bran or bran and sawdust, and distributed at the rate of 15–20 lb. (wet weight) per acre. There is no danger to persons dealing with the preparation and the broadcasting of the baits, provided that the ordinary precautions, which are described in detail, are observed, or to stock, if the bait is distributed thinly and uniformly. At the normal dosages, when crude arsenic is used, each acre of ground receives not more than 204 gm. arsenic trioxide, so that to obtain the toxic doses of 150–700 and 75 grains, respectively, a horse and a sheep would have to consume every particle of bait spread over 230 and 115 sq. yards. When sodium arsenite is used, the amount of arsenic trioxide on a unit of area is less than half that in the case of crude arsenic.

RICHARDS (P. B.). **Sur la destruction des sauterelles au moyen du fluosilicate de sodium.**—*Bull. Off. int. Hyg. publ.* **29** fasc. 5 pp. 972–976. Paris, May 1937.

In 1930, sodium fluosilicate was tested in baits for locusts [*Schistocerca gregaria*, Forsk.] in the Dehra Dun district, India. When baits of 40 lb. bran, ¾–1 lb. sodium fluosilicate and 1 lb. grease or salt, moistened with about 9 gals. water, were broadcast at the rate of 176 lb. per acre, all the locusts, which included older hoppers and adults, were dead in 5 days. Since a great deal of bait still remained on the ground, it is suggested that it should be spread at the rate of 88 lb. to 2½–3 acres.

In tests of the effect of the poison on domestic animals, bulls given doses of from 5 to 25 grains sodium fluosilicate showed no pathological symptoms, and one recovered even after a dose of ½ oz. When 6 bulls, 2 buffalos, 3 sheep and 3 goats were allowed to graze for 8 days on an acre of land over which was spread a mixture of 50 lb. bran, 2 lb. molasses and 1 lb. sodium fluosilicate, they did not appear to have been affected in any way.

GAUD (M.). **Méthodes employées au Maroc pour la destruction des sauterelles et accidents causés au bétail et à l'homme par l'emploi des produits toxiques.**—*Bull. Off. int. Hyg. publ.* **29** fasc. 5 pp. 977–991, 2 maps. Paris, May 1937.

Most of the information in this paper on the campaign against *Schistocerca gregaria*, Forsk., in Morocco in 1927–31 has already been noticed [*R.A.E.*, A **20** 71–73]. Cases of skin affections in man and

of poisoning of cattle that occurred owing to the use of sodium arsenite in poison baits were brought about by lack of the necessary precautions, which are described.

SMITH (R. C.). **Magnesium Sulfate—an unsatisfactory Substitute for Arsenicals in Grasshopper Baits.**—*Science* **86** no. 2227 pp. 226–228, 1 ref. New York, 3rd September 1937.

To test the value of magnesium sulphate (Epsom salts) against grasshoppers, baits of 20–25 per cent. magnesium sulphate mixed with 15 per cent. molasses, 60–65 per cent. bran and sufficient water to moisten, or, at double strength, of 4 lb. magnesium sulphate to 5 lb. of a mixture of bran and sawdust, 1 lb. molasses, $\frac{1}{2}$ oz. amyl acetate and 3 U.S. qts. water, were spread in infested fields at the rate of 7–10 lb. per acre. Both baits were readily eaten by the grasshoppers, but caused no mortality in 4–6 hours, as compared with 80 per cent. mortality in a field similarly treated with baits made of 1 U.S. quart of Pierson-Ferguson hopper poison (a mixture of sodium arsenite, amyl acetate and molasses), 3 lb. bran, 3 lb. sawdust and 1 U.S. gal. water. In another field test, a distribution of 120 lb. of baits containing 20 per cent. magnesium sulphate and 5 per cent. crude calcium chloride ($CaCl_2$) resulted in 4·2 per cent. mortality as against 56·9 per cent. mortality produced by 100 lb. of bait made with Paris green. Spraying cabbages with a nearly saturated solution of magnesium sulphate ($2\frac{1}{8}$ oz. in 100 cc. water at 70°F.) did not injure the plants or kill Lepidopterous larvae on them.

HOWARD (N. F.). **Magnesium Sulfate valueless as a Control for the Bean Beetle.**—*Science* **86** no. 2230 pp. 286–287, 2 refs. New York, 24th September 1937.

In tests carried out in Ohio in 1928 and subsequently, magnesium sulphate (Epsom salts) applied at various strengths as a spray against *Epilachna varivestis*, Muls. (*corrupta*, Muls.) on beans failed to control it. The belief in some quarters of the efficacy of magnesium sulfate [*cf. R.A.E.*, A **25** 417] may be due to the fact that the larvae feeding on sprayed leaves pupated shortly afterwards, so that the growers assumed that the treatment had been effective.

MACLEOD (G. F.) & SHERWOOD (H. F.). **Grenz Radiographs of Sulfur Dispersion on Foliage.**—*J. econ. Ent.* **30** no. 3 pp. 395–398, 3 figs., 1 ref. Menasha, Wis., June 1937.

Grenz-ray radiography was tested as a method of depicting sulphur residues on foliage. Leaves were sprayed with a mixture of 14 gm. 325-mesh sulphur and 1,000 cc. distilled water with either 2 gm. soap, 2 gm. Areskap or 2 cc. Mouillant M (an alkyl-aromatic sulphate) as wetting agent. They were allowed to dry for 6 hours, then half of the sprayed surface was coated with a waterproof lacquer, which dried in 30 mins., and the leaves were submerged in distilled water for 30 secs., dried, and coated with lacquer. The treated leaves were then photographed with Grenz-ray radiation.

The radiographs showed that sulphur deposit was larger when the leaves had been sprayed until they dripped than when they had been sprayed only until one drop formed. Greater initial deposits resulted

in the retention of larger amounts after dipping. The lower surfaces retained more sulphur than the upper surfaces. The Mouillant solution left the heaviest deposit of sulphur, and the soap, which wetted the sulphur most quickly and held it in suspension longest, left the lightest.

SHERMAN III (F.). **Stickers used with Calcium and Zinc Arsenates.**—*J. econ. Ent.* **30** no. 3 pp. 398–399. Menasha, Wis., June 1937.

Several adhesives for calcium and zinc arsenates in a calyx and 5 cover sprays for the control of the codling moth [*Cydia pomonella*, L.] on apple were tested in Michigan in 1936. When zinc arsenate with the addition of 4 lb. iron (ferrous) sulphate and 4 lb. hydrated lime as a corrective and with 1 U.S. qt. Orthol-K medium summer oil per 100 U.S. gals. was used against a moderate infestation, 89 per cent. of the fruit was uninjured, as against 88 per cent. when lead arsenate was used. Against a severe infestation, calcium arsenate with 4 lb. hydrated lime and 4 lb. commercial zinc sulphate as a corrective and the same summer oil as adhesive gave 54 per cent. uninfested fruit, while lead arsenate gave 61 per cent. A fish-oil soap at the same rate as the oil was practically as effective an adhesive in both tests, but bill-posters' paste or soy-bean flour (3 lb. per 100 U.S. gals.) was not.

HAMILTON (C. C.). **Adherence and Rate of Settling of Lead Arsenate Dusts for Autogiro and Airplane Application.**—*J. econ. Ent.* **30** no. 3 pp. 399–404, 1 ref. Menasha, Wis., June 1937.

Laboratory studies were begun in the summer of 1935 on the improvement of the adherence and rate of settling of lead arsenate dusts, with a view to making them suitable for distribution by autogiro or aeroplane.

To test the effect of different kinds and quantities of oils on the adherence of the dusts to oak foliage, 5 gm. of the dust were blown into a box ($4 \times 4 \times 6\frac{1}{4}$ ft.) and allowed to settle on the leaves for 10 minutes. The leaves were washed twice under a fine spray for 15 minutes, and the arsenic trioxide was determined after dusting and after each washing. The dust adhered best in combination with fish oil, "Mineral Seal" oil (viscosity about 70 Saybolt and unsulphonatable residue 92 per cent.) and sperm oil, given in descending order of efficiency. There was very little difference between the results obtained with three other oils, all of which were inferior. All the oils were tested at concentrations of 4, 8 and 12 per cent. Adherence was usually greater when the proportion of oil was high. A petroleum oil having the general properties of the Mineral Seal oil was selected for further work.

Tests were then carried out on the rate of settling of the dusts when combined with oil. The dust was blown into the box and the rate of settling determined by exposing glass plates, one for the first 15 secs., one for the second 15 secs., one for the following 30 secs., and one for the remaining 9 minutes that were required for all the dust to settle. A control plate was exposed for the whole 10 minutes. The rate of fall of the lead arsenate was increased more or less in proportion to the quantity of oil mixed with it, but 20 per cent. oil was the maximum that could satisfactorily be used. Even with this high oil content, only 64·9 per cent. of the dust fell during the first minute.

Of several methods tested for producing lead arsenate dusts that would fall rapidly, the most promising was to mix a diatomaceous earth, Celite, with petroleum oil and lead arsenate. These mixtures settled much more quickly than lead arsenate and oil, and the rate of settling increased with the amount of oil. The best results were obtained with a mixture of 25 per cent. of a comparatively coarse Celite containing a certain amount of round, somewhat firm particles, 25 per cent. oil and 50 per cent. lead arsenate. During the first 15, 30 and 60 secs., 83·3, 96·6 and 99·1 per cent. settled.

HARMAN (S. W.). **Stickers and Spreaders used in Lead Arsenate Sprays for Codling Moth Control.**—*J. econ. Ent.* **30** no. 3 pp. 404–407, 1 fig. Menasha, Wis., June 1937.

Field tests were carried out during 1936 in western New York with various spreaders and adhesives for lead arsenate sprays against the codling moth [*Cydia pomonella*, L.] on apple. Soy-bean flour, skim-milk powder, sulphite lye (lignin pitch) and a fish-oil soap were used in 5 cover sprays in combination with lead arsenate and hydrated lime, which apparently improved spreading as well as preventing possible arsenical injury. Coverage was poor at the first application. The soy-bean flour and skim-milk powder produced a film from July onwards, but the sulphite lye and fish-oil soap failed to do so at all times. The efficiencies, based on total injury, of 3 lb. lead arsenate and 2 lb. hydrated lime in combination with ½ lb. skim-milk powder, 1 lb. sulphite lye, 1 U.S. qt. fish-oil soap or 1 lb. soy-bean flour per 100 U.S. gals. were 70·2, 82·3, 81 and 91·5 per cent., respectively. All residues were easily reduced to within tolerance limits in a flood washer equipped with rotary underbrushes. For heavy infestations, it has been found necessary to use 4–6 lb. lead arsenate. With 1 lb. soy-bean flour and 2 lb. hydrated lime, 6 lb. lead arsenate had an efficiency of 95·7 per cent. and caused no injury, and the residue, though sometimes 15 times the tolerance, could be effectively removed.

DRIGGERS (B. F.). **Five Years' Experiments with Lead Arsenate-Summer Oil in Codling Moth Control.**—*J. econ. Ent.* **30** no. 3 pp. 407–413, 8 refs. Menasha, Wis., June 1937.

Observations were made in New Jersey from 1932 to 1936 on the effect of including oil in cover sprays against the codling moth [*Cydia pomonella*, L.] on apple. At Moorestown, all trees received an application of oil emulsion and cresylic acid at the delayed dormant period, two of lime-sulphur at the pre-blossom stage and one of lime-sulphur and lead arsenate at the petal-fall stage, followed by 7 cover sprays (4 against the first brood and 3 against the second). Two plots were treated every year with lead arsenate combined with Scalecide and Orthol-K, respectively, and during the last three years three adjacent plots were treated with lead arsenate combined with lime or with one of two home-made oil emulsions [*cf. R.A.E.*, A **24** 531]. In the case of treatments including oil (which was applied at the peaks of deposition of first- and second-brood eggs), the first and second cover sprays consisted of 3 lb. lead arsenate and a copper fungicide in 100 U.S. gals. water, the third, fourth, sixth and seventh of 2 lb. lead arsenate and oil amounting to 0·5–0·6 per cent. actual oil in the diluted spray with spreader in 100 U.S. gals., and the fifth

of 3 lb. lead arsenate and 6 lb. lime with spreader in 100 U.S. gals. The remaining plot received 7 sprays of 3 lb. lead arsenate, 6 lb. lime and ½ lb. dry milk powder in 100 U.S. gals., with the addition of a sulphur fungicide in the first two sprays. Orthol-K gave slightly better control than Scalecide throughout the test. The home-made emulsions gave control as good as or slightly better than the commercial oils. The treatments including oil improved upon the control given by lead arsenate and lime. The use of an improved sprayer reduced percentage total injury at harvest on trees that had received Orthol-K and Scalecide from 26 and 31, respectively, in 1932 and 48 and 59 in 1933 to 9 and 12 in 1934 and 3 and 5 in 1935. In 1936, infestation was heavy and the crop light, but control was satisfactory as compared with 1932 and 1933. In 1935, plots sprayed against both broods with lead arsenate combined with Orthol-K, home-made emulsion and lime had 0·1, 0·1 and 0·6 per cent. infested fruit, respectively. Plots that had received the same treatment against the first brood only had 1·1, 1 and 4·9 per cent. infested fruit. The corresponding figures for 1936 were 2·1, 2·1 and 3 for fruit sprayed against both broods, and 11·1, 10·4 and 21·6 for those sprayed against the first brood only. In 1933, 1934, 1935 and 1936, the percentages of uninjured fruit at Glassboro were 13·3, 40·2, 48·3 and 69·2, respectively, on trees sprayed with Orthol-K and lead arsenate, and 10·9, 37·9, 12·4 and 44·4 on trees sprayed with lime, lead arsenate, and milk.

No cumulative injury to the trees was observed on the plots receiving oil in any of the experiments. Some arsenical injury appeared each year on all the plots. In some seasons, the injury caused by lead arsenate and oil appeared to be greater than that caused by lead arsenate and lime. Copper caused slight to moderate injury. When temperatures of about 100°F. prevailed during June, sulphur caused severe scorching. During 1934, severe leaf drop occurred in June about a week after the first application of oil and lead arsenate. This was attributed to an over-vegetative condition, combined with the sulphur residue left from the calyx spray.

CUTRIGHT (C. R.). **Effect of certain Codling Moth Spray Schedules on other Orchard Insects.**—*J. econ. Ent.* **30** no. 3 pp. 413–417. Menasha, Wis., June 1937.

Any spray schedule for the control of the codling moth [*Cydia pomonella*, L.] on apple in Ohio must also be effective against other pests that may increase sufficiently in any season to do economic damage. Work carried out before 1936 had shown that non-lead arsenicals controlled *Rhagoletis pomonella*, Walsh, and might be used against *Conotrachelus nenuphar*, Hbst., and that sprays of summer oil had little effect on *Rhagoletis* unless preceded by several applications of an arsenical, while there was more extensive autumn feeding by *Conotrachelus* on plots treated with them. Two or more applications of summer oil greatly assisted the control of *Chionaspis furfura*, Fitch, and sprays containing nicotine were not successful against *Rhagoletis*. Fluorine compounds controlled *Rhynchaenus* (*Orchestes*) *pallicornis*, Say, and *Conotrachelus*. In tests in 1936, thiodiphenylamine (phenothiazine) at 3 lb. per 100 U.S. gals. used throughout the season, with or without 5 lb. flotation sulphur, 12 cc. Grasselli SS-3 and 200 cc. gelatin (5 per cent. solution) failed to control *Paratetranychus pilosus*, C. & F., *Conotrachelus* or *Cydia*, but gave measurable control of the

green apple aphis [*Aphis pomi*, DeG.], though its action was slow. Flotation sulphur at 5 lb. was not so successful as 1 U.S. gal. liquid lime-sulphur against *P. pilosus*. Ortho Nicotine at 4 lb. per 100 U.S. gals. with 2 U.S. qts. Orthol Ready Mix oil gave fair control of *A. pomi* and *P. pilosus*, but not of *Conotrachelus* or *Cydia*. Control of these was improved when the thiodiphenylamine or oil and nicotine was used after a calyx spray of lead arsenate. Infestation by *Rhagoletis* was not severe, and the differences noticed in control may not have been significant. Several colonies of *Datana ministra*, Drury (yellow-necked caterpillar) were noted feeding on trees where spraying had been discontinued early in the season, but no mature colonies were observed on any of the experimental plots. On one tree sprayed with thiodiphenylamine there were several colonies of very young larvae, all of which were dead. Feeding had apparently lasted for a few hours only.

Worthley (H. N.) & Nicholas (J. E.). **Tests with Bait and Light to trap Codling Moth.**—*J. econ. Ent.* **30** no. 3 pp. 417–422, 3 refs. Menasha, Wis., June 1937.

Studies were carried out in Pennsylvania from 1934 to 1936 with a view to developing a trap for *Cydia* (*Carpocapsa*) *pomonella*, L., as effective as the electrocuting trap used by Parrott and Collins [*R.A.E.*, A **23** 315], but cheaper. From 20th May to 3rd August 1934, an electrocuting trap with a 75-watt bulb, a 6 in. preserving can baited with molasses and water (1 : 9) and suspended below a reflector but unlighted, a similar can lighted with a 75-watt bulb, a similar can without reflector or light, a similar can lighted but supplied with water instead of bait, and a can without reflector or light but with 1 cc. anethol per trap added to the bait, caught 345, 28, 169, 13, 133 and 55 moths, respectively, of which 37·1, 71·4, 43·2, 46·1, 39·1 and 60 per cent. were females. To determine the effect of increasing the trapping surface, 12 in. cake tins were substituted from 4th August to 9th September for the preserving cans in all except the fourth trap, and the anethol was omitted from the last. The numbers of moths caught were 47, 4, 80, 7, 116 and 10, of which 42·6, 50, 47·5, 100, 45·7 and 40 per cent. were females.

Between 23rd May and 1st September 1935, the electrocuting light trap, a reflector and baffles over a 12 in. tin with bait but no light, a similar trap with a light, a 6 in. can with bait but no reflector or light, a reflector over a 12 in. tin with no baffles but with bait and light, and a similar trap without light caught, respectively, 291, 55, 451, 33, 532 and 48 moths, of which 45·7, 54·5, 46·1, 54·5, 39·7 and 70·8 per cent. were females.

Between 6th June and 9th September 1936, the electrocuting trap, a patented trapping globe [**24** 543] unpainted, a similar globe painted black at top and bottom, a third painted black so as to show light only through the slots, a 12 in. baited tin with baffles, reflector and light and a 6 in. baited can with no reflector or light caught 212, 120, 306, 198, 663 and 57 moths, respectively, of which 44·8, 34·2, 28·1, 44·9, 46·8 and 78·9 per cent. were females.

For the years 1934–35, the ratio of moths caught in unlighted and lighted bait traps was 1 : 8 and of females 1 : 6·1. For 1934–36, the ratio of moths caught in the electrocuting trap and in the 12 in. tin under a 75–watt bulb was 1 : 2·17 and of females 1 : 2·26. The cost

of the latter type of trap is one-tenth that of the former. Certain of the moths caught in electrocuting traps are burnt away, but it is improbable that half are so destroyed.

COLLINS (D. L.) & MACHADO (W.). **Effects of Light Traps on a Codling Moth Infestation. A Consideration of four Years' Data.**—*J. econ. Ent.* **30** no. 3 pp. 422–427, 3 figs. Menasha, Wis., June 1937.

From 1933 to 1936, comparisons were made in New York between the infestations of the codling moth [*Cydia pomonella*, L.] on apple trees that were each fitted with an electrocuting light-trap and had received 0, 2, 3 or 4 cover sprays of lead arsenate and unlighted trees that had received 2, 3 or 4 cover sprays [*cf. R.A.E.*, A **23** 315–316]. The results, which are given in charts, show considerable consistency between the various years. Each year, the lighted unsprayed trees had less unmarketable fruit with deep entry holes than unlighted trees that had received 2 cover sprays, but, except in 1935, they had more than those that had received 3, and always more than those that had received 4; but the total number of injured fruit (including "stings") on unlighted trees that received 3 or 4 cover sprays was sometimes greater than on the lighted unsprayed trees. There were more marketable fruits (uninjured or having only one sting) in the lighted unsprayed area than in the unlighted one that had received 2 cover sprays, and, except in 1933, more uninjured fruit on the lighted unsprayed plots than the unlighted plots that had received 3 cover sprays. On all these bases of comparison the lighted plot was better than the unlighted plot that had received the same number of cover sprays.

EDDY (C. O.) & SHARP (S. S.). **Effect of different Spreaders on Thrips Control by Nicotine.**—*J. econ. Ent.* **30** no. 3 pp. 427–430, 2 refs. Menasha, Wis., June 1937.

Tests were begun in Louisiana in 1936 on spreaders and activators for nicotine sulphate for the control of thrips on vegetable crops. They were carried out on *Frankliniella fusca*, Hinds, on shallots in individual pots and free nicotine was used for comparison. The principal spreaders were liquid tar soap (1 : 250), a liquid combined spreader and emulsifier composed of oleic acid, yarmor pine oil, wood resin, cresol, potassium hydroxide and kerosene [*R.A.E.*, A **25** 28] known as E25–61 (1 : 800) and a mixture of 95 per cent. E25–61 and 5 per cent. Palustrex, known as EP3 (1 : 800). In a few tests, other spreaders, including various solid soaps, were also used. With the liquid spreaders, a high concentration of nicotine sulphate was required to kill 90 per cent. of the thrips, and, at an equivalent concentration, it was far less toxic than the free nicotine. Apparently the spreaders did not contain enough alkali to liberate the nicotine from the sulphate, as the addition of potassium hydroxide (4 oz. to 100 U.S. gals.) rendered the sprays toxic at much higher dilutions. The inclusion of Palustrex improved results with both free nicotine and nicotine sulphate. Nicotine sulphate used with the solid soaps killed at the same concentration as it did with the liquid soaps to which potassium hydroxide had been added. Tar soap flakes gave much better results with nicotine sulphate than did the liquid tar soap, but were improved by the use of the additional alkali. Sodium

bicarbonate was of little value as a substitute for potassium hydroxide. The addition of 0·2 per cent. Karaya gum, a product of *Cochlospermum gossypium*, considerably increased the effectiveness of all the nicotine sprays. It rendered additional alkali unnecessary in the case of some of the liquid soaps, but not in the case of E25–61 and EP3. Used in a preliminary test at 0·4 per cent., however, it appeared to overcome the alkali deficiency of these.

EDDY (C. O.) & MEADOWS (C. M.). **Karaya Gum in Nicotine Sprays.**—*J. econ. Ent.* **30** no. 3 pp. 430–432, 1 ref. Menasha, Wis., June 1937.

The value of Karaya gum [see preceding paper] in increasing the effectiveness of sprays of nicotine sulphate with soap spreaders having been established, experiments were undertaken to ascertain its exact effect in such sprays for the control of *Macrosiphum* (*Tritogenaphis*) *ambrosiae*, Thomas, on *Ambrosia trifida*. Nicotine sulphate (40 per cent. nicotine) was used with 0·4 per cent. liquid tar soap or 0·1 per cent. E25–61 [see preceding paper] or mono-amyl-amine oleate. The addition of pine oils or mineral oils (1–4 pts. per 100 gals.) facilitated mixing and increased effectiveness. With the soap spreaders only, a concentration of nicotine sulphate of 1 : 400 was required to give effective control of *M. ambrosiae*. The addition of 0·2 per cent. Karaya gum made it effective at a dilution of 1 : 2,000 in combination with E25–61 or mono-amyl-amine oleate, and at nearly this dilution with liquid tar soap. In similar experiments on *Aphis rumicis*, L., nicotine sulphate in combination with soap killed as effectively at 1 : 2,000 with the addition of 0·2 per cent. Karaya gum as at 1 : 800 without it. Combinations of Karaya gum and soap spreader without nicotine were ineffective.

MACLEOD (G. F.) & MAXWELL (K. E.). **Experiments to control Hairy Chinch Bug infesting Turf on Long Island.**—*J. econ. Ent.* **30** no. 3 pp. 432–437, 2 figs., 11 refs. Menasha, Wis., June 1937.

The literature on the control of chinch bugs [*Blissus leucopterus*, Say, and *B. hirtus*, Montd.] on lawn grass in the United States is briefly reviewed, and an account is given of experiments on Long Island against *B. hirtus* with tobacco and rotenone dusts and a nicotine and soap spray, all of which gave promising results in previous investigations [*R.A.E.*, A **24** 528]. The treatments were applied for each brood after most of the eggs had hatched and before the young bugs caused damage. In experiments for the control of first-generation bugs, half of each plot received one treatment on 16th June and half received two treatments, one during the first week of June and one on the 16th. The spray, which consisted of 40 per cent. nicotine sulphate (1 : 400) and 40 per cent. potassium oleate soap (1 : 100), was applied at the rate of 240 U.S. gals., and tobacco and cubé dusts, which contained 1 per cent. nicotine or rotenone, at 25 lb. to 1,000 sq. ft. All plots treated with dust were raked, and all plots were watered immediately after treatment. No dust treatment caused injury, but scorching was evident for some days after the application of the spray. The plots that had received one application of spray, tobacco dust and cubé dust had 43·9, 40·9 and 20·4 chinch bugs, respectively, per sq. ft., the control plot having 92·4, and plots that

had received two applications had 15·3, 11·1 and 8, the control having 91·4. A difference of 25·6 was significant. The same treatments were repeated on the same plots for the second brood, except that the plots that had served as controls were treated with tobacco dust containing 0·75 per cent. nicotine. None of the dusts was washed in after application. The amount of the spray was reduced to 120 U.S. gals. per 1,000 sq. ft. and it was washed in immediately after application, but again there was slight scorching. The plots that had received one application of dust containing 1 per cent. nicotine, cubé dust, spray, and dust containing 0·75 per cent. nicotine had 13·5, 21·9, 39·3 and 9·7 bugs per sq. ft., and those that had received two had 5·5, 9·7, 14·2 and 3·6, respectively. The low population in plots that had served as controls in the experiments against the first brood was probably due to the fact that there was very little grass left. When tobacco dusts of 0·75 and 1 per cent. nicotine content and cubé dusts of 0·5 and 1 per cent. rotenone content were applied once for each brood on 17th June and 14th August and raked and watered after application, populations per sq. ft. were 9·9, 7·8, 5·2 and 4·6 when 25 lb. had been used per 1,000 sq. ft. for each application, and 1, 1·6, 1·3 and 1·5 when 50 lb. had been used. The significant difference was 3·8. Further experiments were carried out against the second brood on plots that had received no treatment against the first brood, as infestation was light. Single applications were made on 7th August and double ones on 7th and 21st August. The materials were raked in, but not watered, and did not cause scorching. Two applications of tobacco dust with 1 per cent. nicotine at 25 lb. per 1,000 sq. ft., one application of the same dust at 50 lb., and one of dust with 0·75 per cent. nicotine content at 50 lb. reduced infestation from 31·7 bugs per sq. ft. to 0·33, 0·72 and 0·72, respectively. The significant difference was 7·63. An examination of the chinch bug populations on various varieties of lawn and putting-green grass and consequent damage showed a great variation in susceptibility, infestation ranging from 1·7 to 136·7 chinch bugs per sq. ft. in one experiment and 2 to 141·2 in another.

ANDERSON (L. D.) & WALKER (H. G.). **Dusting to control Strawberry Weevil in Virginia.**—*J. econ. Ent.* **30** no. 3 pp. 437–438. Menasha, Wis., June 1937.

Anthonomus signatus, Say, is sometimes a serious pest of strawberries in the coastal regions of Virginia, as many as 75 per cent. of the buds being cut in certain fields. In 1936, experiments on control were conducted in a field that was bordered by pine forests and had been heavily infested in 1935. By 20th April 1936, adults were plentiful and had cut 5–7 per cent. of the buds, and 3 days later, when the first treatment was applied, 17 per cent. had been cut. A second application was made on 29th. Plots were treated at the rate of 40 lb. per acre per application with sulphur and lead arsenate (5 : 1), hydrated lime and lead arsenate (5 : 1), sulphur and derris yielding 5 per cent. rotenone (17 : 3) and sulphur and calcium arsenate (5 : 1) and controls were untreated. The percentages of buds cut were 15, 14, 14, 7 and 39, respectively, a difference of 6·27 being considered significant, and the plots yielded 390, 390, 350, 318 and 241 U.S. qts. fruit per acre, a difference of 59·9 being considered significant. The sulphur and

calcium arsenate caused marked foliage injury. The sulphur and lead arsenate dust has the advantage over the lime and lead arsenate that it gives protection against *Tetranychus telarius*, L.

WALKER (H. G.) & ANDERSON (L. D.). **Control of Larvae of Diamond-back Moth** *Plutella maculipennis* **Curtis.**—*J. econ. Ent.* **30** no. 3 pp. 443–448, 1 fig., 2 refs. Menasha, Wis., June 1937.

In view of the severity of the infestation of crucifers in south-eastern Virginia by *Plutella maculipennis*, Curt., since 1932, an investigation was made into the cause of the inconsistency of results obtained in previous experiments on the control of pests of crucifers with derris. Experiments in the autumn of 1935 on infested collards showed that repeated applications of derris dust containing 0·33 per cent. rotenone at the rate of 35 lb. per acre at intervals of 7–10 days will kill the young larvae of *P. maculipennis* as they hatch, giving good control. Nearly mature larvae, however, are not susceptible to the treatment. This probably accounts for the fact that poor control was obtained with derris in 1934. In a second experiment on collards in the autumn of 1936, 4 applications of derris and talc or cubé and talc (0·75 per cent. rotenone), and a mixture of derris, pyrethrum and talc all at 20–25 lb. to the acre gave satisfactory control, and a good crop was obtained. Noburn, a dust containing not less than 10 per cent. Paris green and 40 per cent. calcium arsenate plus an inert carrier, applied at the same rate, gave good results until its use was discontinued on 6th October because of the danger of high arsenical residues. Control plots produced a very poor and unmarketable crop. A similar experiment was conducted on kale. Three applications during October of Noburn, calcium arsenate with hydrated lime (1 : 1 by weight), derris with Aresket (1 : 600) and talc (0·75 per cent. rotenone), cubé with Aresket (1 : 600) and talc (0·5 and 0·75 per cent. rotenone), and cubé with talc (0·5 and 0·75 per cent. rotenone), all at the rate of 20–25 lb. to the acre, and three applications of Chalk Mixture (a cheap low grade arsenical dust) at 50 lb. per acre, prevented serious injury. Dusts containing Aresket gave slightly but not significantly better results than similar dusts without it. As a result of these tests, kale plants infested with newly-hatched larvae were treated on 31st October and 10th November with derris and talc and cubé and talc dusts containing 0·5 per cent. rotenone, both with and without Aresket, applied at the rate of 25 lb. per acre. Cubé, Aresket and talc gave 87 per cent. control and the other dusts 82 per cent. control.

BAILEY (S. F.). **The Hollyhock Thrips** *Liothrips varicornis* **Hood.**—*J. econ. Ent.* **30** no. 3 pp. 448–450, 1 fig., 9 refs. Menasha, Wis., June 1937.

Liothrips varicornis, Hood, was described in 1912 from grass in Mexico. The first published record of it in California was made by D. Moulton, who observed it on hollyhock in 1926. From further records in the State, all from hollyhock except for one doubtful one from Christmas berry (*Photinia arbutifolia*), it seems to be limited to a semi-arid climate. Larvae and adults feed on the leaves, stem and roots of the food-plant, making scars or depressions in the stem, which they often penetrate and attack from the inside, and causing the leaves to wither by feeding at the axil of the main and leaf stem.

The roots are sometimes scarred to a depth of 4 ins. below the surface of the ground. Plants are not known to have been killed by this thrips alone. Overwintering takes place in the roots, usually in the adult stage. Larvae have been found up to 25th December and pupae up to 1st December, but only adults have been known to survive the months January–March. In spring, they move to new growth; pairing begins at the end of March or beginning of April and oviposition about 2 weeks later. The eggs are laid in the angles of the leaf and main stems, under the bracts, or in depressions and cracks in stem and roots. A female lays, on an average, 10–12 eggs. Oviposition in one colony extends over about a month, and all adults die before the end of May. The egg and larval stages last about 4 and 3 weeks, respectively. If feeding has taken place in an exposed position, the larva usually goes below ground to pupate, but pupation often occurs inside the stems among immature larvae. The prepupal and pupal stages last 1–3 and 6–8 days, respectively. In the pupal stage, the insect is mobile but takes no food and makes no cell. Adults emerge from the end of June and often pair before feeding. Activity is greatly reduced during July and August. The ratio of males to females is 1 : 3. From the time when the first adults of the second generation emerge, there is a certain overlapping of generations. The second generation is small and all the stages are shorter than in the spring. Dry weather favours multiplication, as the immature stages are killed by autumn and winter rains. No natural enemies have been observed. Dispersion is slow, and the adults are not known to fly. Heavy watering round the base of infested plants and the destruction of old stalks and self-sown plants in autumn and early winter are considered sufficient for control.

COMPTON (C. C.). *Lineodes integra* **Zell., a potential Pest of Greenhouse Tomatoes.**—*J. econ. Ent.* **30** no. 3 pp. 451–454, 1 fig. Menasha, Wis., June 1937.

Lineodes integra, Zell., has been recorded as feeding on a number of solanaceous plants, including tomato, egg-plant, potato, pepper [*Capsicum*] and nightshade, but was not considered a pest until injury to tomatos in greenhouses was reported from two districts in Illinois in 1934 and 1935. Although there are no records of this Pyralid occurring outdoors in Illinois, the infestations appeared to have developed from the migration of moths into the greenhouses from outdoor plants. All parts of the plant above the ground level are subject to attack. In experimental houses, plants that had set their third cluster of fruit were killed unless control measures were applied. The larva feeds on the underside of the leaf, sometimes devouring the blade entirely, and the petiole may also show feeding scars. As the larva matures, it cuts and rolls the leaf. The surface of the main stem and branches is frequently attacked, and the pedicels eaten into or girdled. The fruit is attacked at all stages, usually beneath the sepals, but sometimes at a point of contact with another fruit or with the foliage. Feeding is mostly confined to the surface, and renders the fruit unfit for market.

Adults are active at sunset and pair and oviposit during the night. Ten females in wire cages in a greenhouse deposited 21–79 eggs each, the average being 62. The eggs, which are deposited singly or in groups on the undersides of the leaves, on the sepals, and even on the

stems, hatch in 7–10 days. The larvae were observed to have 5 instars, each lasting about 5–7 days. Pupation takes place on the plant, inside a rolled leaf or in a lightly constructed cocoon in the axils of the stems or in crevices in the stem. The pupal stage lasts 8–13 days. Three complete generations and a partial fourth developed from eggs laid on 21st October in a greenhouse, before the crop of tomatos was finished in the spring.

A dust of sulphur and lead arsenate (85 : 15 by weight), applied 3 times at intervals of 8–10 days, gave excellent control. This dust may be safely used until the first cluster of fruit is a little more than half developed. A dust containing 0·5 per cent. rotenone was effective, but did not give quite such good control. A proprietary spray containing 6 per cent. pyrethrum extractives, used at a dilution of 1 : 300, killed all larvae that were thoroughly wetted, but was less effective and more expensive than the dusts. Hand-picking of the resting adults during the day helps control.

McDaniel (E. I.). **White Coating on Foliage a Repellent for Potato Leafhopper.**—*J. econ. Ent.* **30** no. 3 pp. 454–457, 3 refs. Menasha, Wis., June 1937.

Experiments on the degree to which a white coating on foliage is repellent to *Empoasca fabae*, Harr. [*cf.*, *R.A.E.*, A **24** 544] were carried out in Michigan in 1936 with lucerne, dahlia and potato. Applications of flour, lime or talc to form barrier strips effectively protected lucerne from infestation through migration of the leafhoppers from neighbouring infested fields. The population of leafhoppers on dahlias in the experimental field was much lower than in 1935, but there was a marked difference between plants dusted with lime or flour, both of which satisfactorily freed them from infestation, and controls to which the leafhoppers migrated from the dusted plants, and which were stunted and in many cases produced no flowers. Lime was more satisfactory than flour, as it formed a smoother coating and adhered for 7–10 days longer. Both dusts also repelled *Aceratagallia* (*Agallia*) *sanguinolenta*, Prov. In experiments on the relative value of sulphur, flour, lime and talc as repellents on potato, applications of sulphur had to be discontinued at the beginning of the season as it scorched the foliage. Infestation was consistently lowest on the plots dusted with lime. Flour was less effective than talc, but the plots dusted with it had only half as many leafhoppers as the controls.

Goodhue (L. D.). **Particle Size of commercial Calcium Arsenates by Sedimentation Analysis.**—*J. econ. Ent.* **30** no. 3 pp. 466–474, 4 figs., 7 refs. Menasha, Wis., June 1937.

The following is the author's summary : The particle-size distribution, the loose bulking value, the density and the angle of slope were determined for 22 commercial calcium arsenate samples. The particle-size distribution and loose bulking value varied greatly, while the density and angle of slope showed less variation. The special grades produced by some of the companies were, in every case, finer than their standard grades. A comparison of the loose bulking values and the particle size by sedimentation showed little correlation. It is pointed out and substantiated by photographs that the bulking value so often used as a measure of particle size is

unreliable and often entirely misleading. A correlation between density and particle size has been pointed out. The finest samples have the highest densities.

Nelson (O. A.) & Cassil (C. C.). **An Examination of commercial Calcium Arsenates.**—*J. econ. Ent.* **30** no. 3 pp. 474–478, 2 figs., 6 refs. Menasha, Wis., June 1937.

The results of an examination of several brands of calcium arsenate on the market as insecticides in the United States in 1936 are given in a table, together with such figures as were available concerning the same brands as sold in previous years, and which were reported in papers already noticed [*R.A.E.*, A **19** 308; **24** 256]. There is shown to be no relation between the percentage of free lime and that of water-soluble arsenic, or between the percentages of water-soluble arsenic obtained by the method of Pearce, Norton and Chapman [**24** 256] and by that of the Association of Official Agricultural Chemists. There was a considerable variation in the analyses and molar ratios of calcium oxide to arsenic pentoxide in the same brands from year to year. The anomalies discovered in the analyses are discussed. Despite a lack of equilibrium conditions in the manufacture of calcium arsenate, solubility lessened with an increase in the ratio of calcium oxide to arsenic pentoxide. There was also an apparent correlation between soluble arsenic as determined by the method of Pearce, Norton and Chapman and particle size as determined by Goodhue [see preceding paper]. In every case, special grades were finer, more basic, and had less soluble arsenic than the regular product of the same manufacturer.

Keen (E. P.) & Furniss (R. L.). **Effects of Subzero Temperatures on Populations of Western Pine Beetle** *Dendroctonus brevicomis* **Lec.**—*J. econ. Ent.* **30** no. 3 pp. 482–504, 5 figs., 7 refs. Menasha, Wis., June 1937.

Dendroctonus brevicomis, Lec., is destructive to the ponderosa pine [*Pinus ponderosa*] throughout the Pacific coast area of distribution of the tree, where the air temperature normally has a range of from −10° to 105°F., to which the beetle is well adapted. Temperatures sufficiently low to kill part of the overwintering broods occur from time to time on the eastern slopes of the Sierra Nevada and Cascade range. In central Oregon, appreciable killing occurs approximately once in 3 years and severe killing once in 10 years. There is evidence that the north-eastern limits of distribution are determined by minimum winter temperatures. Females lay eggs along galleries in the phloem or inner bark. The larvae mine the phloem for a time, then most of them migrate into the corky bark where, after further growth, pupation and adult emergence take place. In an area of north-eastern California, examined in 1932–33, the percentages of individuals found to be overwintering as eggs, first- and second-instar larvae, third- and fourth-instar larvae and young adults were 1·5, 26·8, 71·1 and 0·6. Normal mortality from the egg to adult stages is 85 per cent., most of which takes place during transformations from one stage to another. During the winter, no transformation takes place for several months and mortality

usually does not exceed 5 per cent., when fatal temperatures do not occur.

The results of investigations on the effects of periods of prolonged cold in December 1932, intense cold in February 1933 and unseasonable cold in November 1935 are here reported. When samples were examined immediately after the cold period in 1932, the percentage mortality ranged from 9·2 where the approximate minimum temperature was −3°F., to 84·5 where it was −30°F. Following the combined cold spells of December and February, the highest percentage recorded was 90·7, correlated with an approximate minimum temperature of −35°F. Mortality caused by cold extended along the east of the mountains from northern California to northern Washington and presumably into Canada. The effect of the cold period in 1935 was largely limited to southern and central Oregon, where mortality in various districts in which the minimum temperatures ranged from 2 to −20°F. was 6·8–60·7 per cent. The difference in the amount of kill effected by the three types of cold spells was not significant, but indicated that prolonged cold is more effective than unseasonable cold and unseasonable cold than short, intense cold. In 1933, higher mortality was caused by a given temperature in northern California than by the same temperature further north.

Various factors influence the correlation between recorded temperatures and mortality. Among these is the discrepancy between temperatures in the exposed situations where the records were made and those in the forests. The thickness of the bark modifies the subcortical temperatures [*R.A.E.*, A **23** 174]. A representative investigation showed that nearly 95 per cent. of all the bark was from $\frac{5}{8}$ in. to $1\frac{1}{2}$ ins. thick. By multiplying the percentage of *D. brevicomis* occurring under various thicknesses of bark in each bark-thickness group by the relative abundance of that group, it was estimated that the percentages of large larvae under $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, and 2 ins. of insulating bark were 27·3, 41·4, 22, 6·6, 1·8, 0·6, 0·2 and 0·1, and of eggs and young larvae 9·4, 33·2, 39·4, 12·6, 3·7, 1·1, 0·4 and 0·2, respectively. It can be assumed therefore that in central Oregon about 95 per cent. of the overwintering brood are protected by 1 in. of bark, or less. Correlation of these figures with data obtained by J. A. Beal shows that this covering of bark gave a protection of 8–21°F., and that a higher degree of protection was given to the small percentage protected by thicker bark. In general, brood mortality varies inversely with the thickness of the bark in which the brood overwinters, except in the case of insulation of less than $\frac{1}{2}$ in. Mortality was shown to vary with the height on the tree, being 19·7 per cent. less at the base (5–20 ft. from the ground) than the average for the entire tree. Above the base, mortality was the same for bark of the same thickness.

Mortality through cold decreased with an increase in the distance of the brood from the inner bark, although individuals in the inner bark are protected by the greatest thickness. This is probably because the moisture content of the phloem is 6–7 times greater than that of the outer bark [*cf.* **20** 15]. Studies by W. J. Buckhorn have shown that in a mild winter, only about 20 per cent. as many adults emerge from trees containing young larvae as from those containing old. Young larvae confine their activity to the phloem. Mortality after periods of very cold weather is greater on the north than on

the south side of infested trees, and in trees with tight bark than in those with loose bark. Older larvae are usually distributed in the bark in one of two patterns, being either concentrated in or very close to the phloem, in which case they are smaller than average and mortality is high, or else scattered, but chiefly well removed from the phloem, in which case they are normal in size and mortality is low.

Counts in central and southern Oregon showed that the emergence in the spring of 1933 was less than 20 per cent. of the normal, and approximately the same reduction was noted in northern California. Infestation in 1933 was considerably less than in 1932, but the reduction was not proportionate to the mortality caused by cold. Infestation trends in southern Oregon for the years 1921–34 indicate that cold weather has no very noticeable effect in arresting outbreaks, except that in 1933, the cold apparently operated in the same direction as the infestation trend and accelerated the decline. A kill of 50 per cent. or more is considered necessary to cause modification of control plans, and as cold only reduces the population without modifying the factors that cause it to increase, its effectiveness is short.

Of the predators of *D. brevicomis*, *Temnochila virescens* var. *chlorodia*, Mann., is less resistant to cold, as is also *Thanasimus nigriventris*, Lec. (*Enoclerus lecontei*, Wolc.), but the latter migrates to the soil at the base of the tree, where it is protected. Larvae of the Lamiid, *Acanthocinus spectabilis*, Lec., which destroy some larvae of *Dendroctonus* by competing with them for space and food, are killed by about the same temperatures as the latter.

Compton (C. C.) & Kearns (C. W.). **Improved Control of Red Spider on Greenhouse Crops with Sulfur and Cyclohexylamine Derivatives.** *J. econ. Ent.* **30** no. 3 pp. 512–522, 10 refs. Menasha, Wis., June 1937.

This is a progress report on investigations in Illinois under laboratory, field and greenhouse conditions, on the control of the red spider, *Tetranychus telarius*, L., chiefly on greenhouse plants. There was shown to be a great variation in the susceptibility to certain sprays of individuals of *T. telarius* from different food-plants. Selocide (8 per cent. potassium-ammonium-seleno-sulphide) at 0·25 and 1 per cent. with Aresket 240 at 0·2 per cent. gave 100 per cent. kill on snapdragon [*Antirrhinum*], but only 2 and 36 per cent., respectively, on rose. Ammonium polysulphide and potassium sulphide were also less effective on rose. Very encouraging results were obtained out of doors with ammonium polysulphide composed of 10 per cent. sulphur dissolved in ammonium sulphide, prepared by saturating ammonium hydroxide (28 per cent. NH_3) with hydrogen sulphide. Increasing the percentage of sulphur did not make the spray much more toxic, but increased danger of foliage injury. In tests on raspberry and various flowering plants, ammonium polysulphide at 0·5 per cent. gave as good control as Selocide at the same concentration with an additional spreader or at 2 per cent. without. Neither injured the foliage at 0·5 per cent., but at 1 per cent. ammonium polysulphide caused slight injury to some plants. Both were more effective than potassium sulphide at the same concentration. The latter at concentrations over 0·33 per cent. injured the young leaves of certain plants. The use of ammonium polysulphide in the greenhouse is limited by the fact that the gases given off are toxic to some plants.

Yellowing and premature dropping of rose foliage may be caused by ammonia. Hydrogen sulphide is also a contributing factor. All stages of *T. telarius*, including eggs on rose and snapdragon, were killed by fumigating them for a short time with a relatively high concentration of hydrogen sulphide, the most toxic agent evolved by sulphur and sulphides. Potassium sulphide caused injury to certain plants, including rose, at concentrations greater than 0·5 per cent. The sulphides tend to injure the petals of full-blown flowers. For best results, a temperature above 75°F. and a relative humidity below 40 per cent. are required. A good wetting agent is essential. Aresket 240 at 0·2 per cent. and Grasselli Spreader at 0·125 per cent. gave excellent results.

N, N-amyl-benzoyl cyclohexylamine and N, N-amyl-acetyl cyclohexylamine [*R.A.E.*, A **25** 433] were found to be highly toxic to *T. telarius* and safe to apply to most outdoor crops, but not to greenhouse plants. However, a new derivative of cyclo-hexylamine known as C.P. 100 was more toxic than either and, at concentrations sufficient to kill almost all the mites, was safe for plants in the greenhouse except for slight injury to rose. A solution containing 70 per cent. C.P. 100 and 30 per cent. Albasol (a sulphonated codfish oil) was readily miscible and very stable in aqueous solutions, and at 0·33 per cent. equalled in effectiveness Selocide at 2 per cent. and gave a good kill on rose. Only 0·083 per cent. was required to give the same kill on *Ageratum*.

The use of Karaya gum [**25** 688] and certain other plant gums greatly increased the effectiveness of the various sulphur compounds and other materials tested, and made them safer. Syringing with clear water at intervals will probably remove the gum residue. Karaya gum gave the greatest effectiveness combined with economy. With the sulphides, it is necessary to use the gum at 0·2 per cent. concentration, but with C.P. 100, 0·1 per cent. is satisfactory. Karaya gum with spreader, but without a toxic agent, produced a considerable percentage of mortality, so that its value is not due solely to the greater quantity of spray that it fixes to the leaf-surface. Owing to its high water-holding capacity, it is difficult to get into a water solution. The best method appears to be to wet it with alcohol (250 cc. for 4–6 oz. gum) and to pour the mixture slowly into the spray solution (containing the spreader) while agitating constantly.

Common Names of Insects approved for general Use by the American Association of Economic Entomologists.—*J. econ. Ent.* **30** no. 3 pp. 527–560. Menasha, Wis., June 1937.

This list, which is compiled in two parts, in which the popular and scientific names of insects, respectively, are arranged in alphabetical order, combines the popular names so far approved by the Association, with the names that received the vote for adoption in 1937, and supersedes all previous lists [*R.A.E.*, A **20** 142, etc.].

Cotton (R. T.), Wagner (G. B.) & Young (H. D.). **Oxygen as a Factor in Vacuum Fumigation.**—*J. econ. Ent.* **30** no. 3 p. 560, 1 ref. Menasha, Wis., June 1937.

Recent experiments have confirmed previous conclusions that oxygen deficiency and not low pressure is responsible for the increased effectiveness of fumigation under vacuum conditions [*R.A.E.*, A **20**

696]. Fumigation for 1 hour with ethylene oxide and carbon dioxide (9 : 1) at 10 lb. per 1,000 cu. ft. at an absolute pressure of 2½ ins. and an air temperature of 64°F. killed all adults of *Tribolium confusum*, Duv., whereas when the air was pumped from the vault until the absolute pressure was ½ in. and pure oxygen was introduced until an absolute pressure of 2½ ins. was obtained, fumigation at 67°F. gave no kill. Apart from the slight difference in temperature, the conditions differed only in that the oxygen content of the vault was reduced from the normal 21 per cent. to 1·77 per cent. in the first test and was 7·26 per cent. in the second.

Poos (F. W.) & Batten (E. T.). **Greatly increased Yields of Peanuts obtained in Attempts to control Potato Leafhopper.**—*J. econ. Ent.* **30** no. 3 p. 561, 1 ref. Menasha, Wis., June 1937.

Following preliminary tests in Virginia in 1932 and 1933 in which Bordeaux mixture (4 : 4 : 50) applied for the control of *Empoasca fabae*, Harr., increased the yield of ground-nuts by an average of 21 per cent., further experiments were carried out in 1934. Applications of Bordeaux mixture on 11th July, and 4th and 20th August resulted in a yield 60–73·9 per cent. greater than that of unsprayed plots. During 1935, treatment with sulphur, Bordeaux mixture and two other copper compounds increased yield by 19–50 per cent. During 1936, increase from treated plots ranged from 30 to 60 per cent. *E. fabae* was not sufficiently abundant to be responsible for all the decrease in yield. The treatments certainly also controlled disease and probably stimulated the plants.

Robinson (R. H.) & Childs (L.). **Zinc Oxide-Zinc Acetate Mixture as a Safener for Arsenical Sprays.** —*J. econ. Ent.* **30** no. 3 pp. 561–562. Menasha, Wis., June 1937.

A mixture of 4 parts zinc oxide and 1 part zinc acetate added at the rate of ½ lb. per 100 U.S. gals. spray to a tank of water to which lead or zinc arsenate was then added, prevented the formation of more than a trace of water-soluble arsenic. Certain spray waters from south-western Oregon that ordinarily react with lead arsenate attained an equilibrium with only a trace of water-soluble arsenic when the mixture had previously been added to them. The addition of the mixture to water containing soluble sulphates, carbonates and chlorides prevented the formation of water-soluble arsenic when various types of calcium arsenate were added. In 1936, zinc oxide was used experimentally in calcium arsenate sprays for the control of the codling moth [*Cydia pomonella*, L.] in Oregon and reduced arsenical injury to the calyx of one variety of apple from 28·4 to 1·9 per cent. Where severe injury may occur, the use of the mixture of zinc oxide and zinc acetate at the rate of 1 lb. to 100 gals. is recommended.

Fleming (W. E.) & Baker (F. E.). **Effect of Ferric Oxide on acid Lead Arsenate as a Stomach Poison and Repellent for Japanese Beetle.**— *J. econ. Ent.* **30** no. 3 p. 562, 3 refs. Menasha, Wis., June 1937.

In an experiment in which 8 or 16 lb. ferric oxide was added to sprays of 8 lb. acid lead arsenate in 100 U.S. gals. water with a view

to decreasing arsenical injury to trees sprayed for the control of the Japanese beetle [*Popillia japonica*, Newm.], mortality of the beetles was significantly reduced and feeding was increased to an extent approaching significance.

PECHUMAN (L. L.). *Lariophagus distinguendus* **Foerst. parasitic on** *Sitodrepa panicea* **L. in New York.**—*J. econ. Ent.* **30** no. 3 p. 563, 9 refs. Menasha, Wis., June 1937.

In December 1936, some ice cream powder in New York was found to be infested with larvae of *Sitodrepa panicea*, L. The infested material was kept at room temperature. After a few days, an adult Pteromalid was found, and two more were observed in January. An examination showed that many of the Anobiid larvae had parasitic larvae clinging to them. The parasitised material was killed and preserved, and no more adult parasites appeared. Adult Anobiids began to appear in February and several hundreds were present in March. The Pteromalids were determined by A. B. Gahan as *Lariophagus distinguendus*, Först., which parasitises several insects infesting stored products, and has been reared as a parasite of *S. panicea* in Europe, but has not been recorded from it in the United States.

POWELL (D.). **New Technic for hatching Codling Moth Eggs.**—*J. econ. Ent.* **30** no. 3 pp. 563–564, 2 refs. Menasha, Wis., June 1937.

A new hatching box has been devised to replace that previously used in Illinois for rearing *Cydia* (*Carpocapsa*) *pomonella*, L. [*R.A.E.*, A **18** 386]. It consists of a circular cardboard carton of ½ U.S. pt. capacity. The cover is replaced by a 9 cm. Petri dish fastened with a rubber band. Perforated cellophane squares bearing eggs are placed one on top of the other in the carton, not more than 500 eggs being kept in each box. The larvae, upon hatching, collect on the box or cover and can be removed with a camel-hair brush. They are transferred at intervals of 4 hours from 8 a.m. till 8 p.m. This provides a supply of uniform newly-hatched larvae in good condition.

GILMORE (J. U.) & MILAM (J.). **Improved poisoned Bait for Corn Root Webworm affecting Tobacco.**—*J. econ. Ent.* **30** no. 3 p. 564. Menasha, Wis., June 1937.

Crambus caliginosellus, Clem., is an important subterranean pest of young tobacco in certain districts of the United States. A bait for its control was made up of 1 lb. Paris green, 25 lb. maize meal and 1 oz. nitrobenzene, and gave best results when sifted at the rate of 15–20 lb. per acre on to the tobacco plants immediately after they had been transplanted.

MACKIE (D. B.) & CARTER (W. B.). **Methyl Bromide as a Fumigant. A preliminary Report.**—*Bull. Dep. Agric. Calif.* **26** no. 2 pp. 153–162, 4 figs. Sacramento, Calif., 1937.

This is a preliminary report on experiments in California to determine the value of methyl bromide as a fumigant for insect pests [*cf. R.A.E.*, A **25** 557; **24** 73; **23** 194]. Exposures to dosages that are lethal for insects in general damaged plants less than similar treatments with hydrocyanic acid gas or carbon bisulphide. The foliage of some

flowering plants, however, became spotted and died, although the blossoms were not affected. The effectiveness of methyl bromide is not lessened in the presence of moisture ; the concentrations lethal for *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, in tomato were the same as for *P.* (*G.*) *operculella*, Zell., in potato. Its action is rather slower than that of hydrocyanic acid gas or carbon bisulphide, but insects that are still active at the end of the fumigation period generally become comatose within 24 hours and eventually succumb. In experiments on *P. operculella* in potatoes, complete mortality of all stages resulted from an exposure of 90 minutes to a dosage of 2·5 lb. 99·5 per cent. methyl bromide per 1,000 cu. ft. In tests on an industrial scale, 220 trucks of potatoes were successfully treated.

Lemon and orange trees infested with resistant red scale, *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., were fumigated with a dosage of 4·5 lb. per 1,000 cu. ft., with a resulting mortality rate of 100 per cent. Other workers have shown that an exposure of 3 hours to a concentration of 3 lb. per 1,000 cu. ft. gave complete control of adults of the Japanese beetle [*Popillia japonica*, Newm.] in hampers of green vegetables, without injury to the latter.

A table shows the vacuum fumigation exposures necessary at different summer temperatures to produce 100 per cent. mortality in eggs, larvae and pupae of *P. operculella*, larvae of *P. lycopersicella*, adults of *Calandra* (*Sitophilus*) *granaria*, L., and *Tribolium confusum*, Duv., larvae and pupae of *Cydia* (*Carpocapsa*) *pomonella*, L., several Coccids and a mite, and the plants or products treated. Another table gives the results of tolerance tests for a number of vegetables and flowering plants.

The technique of fumigation is shortly described. The effect of the fumigant on man has not been thoroughly investigated, but in one case it caused vertigo and vomiting [*cf.* **23** 194].

KEIFER (H. H.). **California Microlepidoptera X–XI.**—*Bull. Dep. Agric., Calif.* **25** no. 3 pp. 349–359, 3 pls. ; *Op. cit.* **26** no. 2 pp. 177–203, 7 pls., many refs. Sacramento, Calif., 1936–37.

In the first of these papers, which belong to a series [*R.A.E.*, A **24** 602], a description is given of the adults of both sexes of *Phthorimaea* (*Gnorimoschema*) *elmorei*, sp. n., as well as notes on the characters distinguishing the adults, pupae and larvae from *P.* (*G.*) *lycopersicella*, Busck, with which it has been confused in the past. It is more widely distributed in California than the latter and breeds on native species of *Solanum*, whereas it now appears that *P. lycopersicella* occurs there under natural conditions only on tomato. The life-cycle of both species is completed in the same length of time, and the larvae of both are leaf-rolling miners. *P. elmorei* does not appear to hibernate, and all stages can be found throughout the year. In experiments by J. C. Elmore, a female *lycopersicella* was paired with a male *elmorei* and oviposited on 28th April. The eggs were fertile and gave rise to males emerging on 11th June and females emerging from 28th June to 4th July. In normal species both sexes emerge at the same time. Unsuccessful attempts were made to repeat this crossing and to pair hybrid males with hybrid females, hybrid females with *lycopersicella* males, and *elmorei* females with *lycopersicella* males. *P. lycopersicella* was experimentally reared on native *Solanum*, though all collections of larvae from these plants have so far failed to produce anything but

elmorei. Adults of *elmorei* kept on tomato produced some tomato-feeding larvae, but it is considered unlikely that such a strain would be produced under field conditions. In one locality, a tomato field next to heavily infested *Solanum umbelliferum* did not develop a heavy infestation, and an attempt to transfer half-grown *elmorei* larvae from native *Solanum* to tomato failed.

In the second paper, records of the distribution of *P. lycopersicella* are reviewed with a view to obtaining evidence of its country of origin. Descriptions are given of a number of other Californian Microlepidoptera, including *Phthorimaea* (*Gnorimoschema*) *altisolani*, sp. n., reared from *Solanum xantii*.

Donohoe (H. C.), Barnes (D. F.), Fisher (C. K.) & Simmons (P.). **The Use of Shade Cloth to exclude the Raisin Moth from Drying Fruits.**—*Bull. Dep. Agric. Calif.* **26** no. 2 pp. 204–206, 1 fig. Sacramento, Calif., 1937.

Further information is given on the use of shade cloth for preventing the infestation of drying fruits by *Ephestia figulilella*, Gregson, in California [*cf. R.A.E.*, A **23** 37, etc.]. The reduction in the percentage infestation of exposed and protected apricots, nectarines, peaches, pears and Adriatic figs was from 49·0 to 0, 59·0 to 4·7, 68·8 to 2·3, 15·5 to 3·6, and 18·9 to 1·7, respectively.

Watson (J. R.). *Naupactus leucoloma* (**Coleoptera, Curculionidae**) **a Pest new to the United States.**—*Florida Ent.* **20** no. 1 pp. 1–3, 1 fig. Gainesville, Fla, July 1937.

Larvae of *Naupactus leucoloma*, Boh., a South American weevil [*cf. R.A.E.*, A **21** 303] that has not previously been recorded in the United States, were found on cotton and ground-nuts in northern Florida during 1936, and caused very severe damage in a restricted area there in 1937, destroying much of the cotton and maize and also attacking velvet beans [*Stizolobium*], ground-nuts and all other crops on the infested fields, as well as many weeds. They kill the plants by making large cavities in the underground stems. Larvae of all ages were found at the same time, which suggests that the oviposition period is protracted, but the first adults were observed on 15th June, so that there is probably only one generation a year. According to one observer they did not fly, but crawled over the fields in large numbers and could be caught in a ditch with perpendicular sides. It was also observed that one field that had been heavily infested in 1936 was much less so in 1937, apparently because pigs had been allowed to graze in it during the intervening winter and spring. At the time of writing, the weevil had been found in two very small areas of northern Florida and in adjoining parts of Alabama.

Warner (J. D.). **Sugar Cane Mealybug Control on Seed Cane, with special Reference to cold Water Treatment, at the North Florida Experiment Station.**—*Florida Ent.* **20** no. 1 pp. 6–7. Gainesville, Fla, July 1937.

A general infestation by *Pseudococcus boninsis*, Kuw. (*calceolariae*, auct.) of all varieties of sugar-cane at the North Florida Experiment Station was observed in 1934, and experiments on its control on canes

removed for planting at some distance from the infested fields were carried out in 1934-36. The successful treatments were the submergence of the seed-cane in a 5 per cent. solution of an aliphatic thiocyanate (lethane 420) [*cf. R.A.E.*, A **24** 731, etc.] with lethane spreader for 12 hours, and immersion for 7 days, after windrowing for 3 months, in cold flowing water. Canes were then planted out and when examined a year and 9 months later, respectively, were found to be free from infestation. Canes submerged in water for 21 days gave broken stands, although they were healthy and not infested. Other treatments tested were immersion in the lethane solution for 30 minutes, and submergence for 25 minutes, after windrowing for 4 months, in a solution of 0·25 per cent. nicotine sulphate with a soap spreader at 65°F.; infestation was found 6 months and a year later, respectively.

Tanganyika Territory. Plant Protection Ordinance 1937.—Ord. no. 9 of 1937, 6 pp. Dar es Salaam, 23rd April 1937.

This Ordinance empowers the Governor to make rules for the prevention and control of attack by or spread of declared pests or diseases of plants or plant products within Tanganyika Territory by means of disinfection, regulation of cultivation of any plant concerned, quarantine of affected areas or other measures; and also rules for the prevention of importation into the Territory of pests, whether declared or not, by means of disinfection, regulation of import or export of articles likely to spread pests or diseases, and other measures. Rights of entry to land or buildings are provided to facilitate the enforcement of these rules. A previous Ordinance [*R.A.E.*, A **10** 95] is superseded, but orders or regulations made under it have effect as if made under the new Ordinance.

Tanganyika Territory. The Cotton Ordinance 1937.—Ord. no. 12 of 1937, 14 pp. Dar es Salaam, 23rd April 1937.

This Ordinance, which supersedes an earlier one [*cf. R.A.E.*, A **10** 96], includes a section empowering the Director of Agriculture, with the approval of the Governor and for the purpose of preventing the spread of any cotton pest or disease, to place in quarantine any area concerned and regulate therein the movement and destruction of cotton, cotton seed, etc., and the sowing of cotton seed or any other specified crop known to harbour cotton pests, and also to regulate, in any area, the time of harvesting and the destruction of any cotton plants, cotton residues, refuse or any specified plant in or near any cotton field. Raw cotton may not be stored for longer than a month from the date fixed for the destruction of cotton plants, except in approved premises.

[Danilevskii (A. S.). Данилевский (А. С.). **The Part of Food-plants in the Biology of *Loxostege sticticalis* L.** [*In Russian.*]—*Rev. Ent. URSS* **26** (1935) pp. 91-110, 2 graphs, 30 refs. Leningrad, 1936. (With a Summary in English.) [Recd. 1937.]

A detailed account is given of laboratory experiments in Russia in 1933 and 1934 on the effect of various food-plants on the development of *Loxostege sticticalis*, L. Newly hatched larvae were kept individually at about 25°C. [77°F.] and 100 per cent. humidity until they pupated, and fed on 16 species of plants. These could be divided according to their effect on the larvae into three groups. Larval

development was completed in the shortest average period (11½–13 days), mortality was lowest (31·5–46·6 per cent.) and the weight of the pupae was greatest (32·5–38·3 mg.) on *Chenopodium album*, *Kochia prostrata*, beet and *Aegopodium podagraria*; larval development occupied a longer time (13·5–18·3 days), mortality was high (53·3–74 per cent.) and pupal weight low (22·6–30·2 mg.) on clover, *Polygonum aviculare* and several species of *Artemisia*; and no larvae matured on *Agropyrum repens*, *Obione verrucifera*, *Salicornia herbacea*, maize or tobacco (*Nicotina rustica* and *N. tabacum*). On the second and third groups, the duration of the individual larval instars and the rate of mortality progressively increased as the larvae became older, but larvae fed during the first and second instars on optimum plants became more resistant with age to unfavourable ones and were able to complete development on almost any of the plants tested. Resistance to tobacco was acquired only after the larvae had fed on *Chenopodium* during the first three instars. In experiments on the fifth instar, the consumption of dry matter and oxygen was greatest on favourable food-plants. The fat contents of larvae that had fed on *Chenopodium*, beet and clover were 24·7, 20·3, and 15·6 per cent., respectively. Larvae given a choice tended to prefer the plants of greater nutritive value, but also showed a preference for the plants on which they had fed prior to the experiment, which indicates that adaptation is rapid and frequent active migrations in the field unlikely.

Females reared on *Chenopodium* had the shortest average adult life (13½ days), but deposited the greatest number of eggs (average 255), whereas the corresponding figures for those reared on clover and *Artemisia vulgaris* were 19·3 and 20·2 days and 186 and 172 eggs, respectively. Moreover, up to 40 per cent. of such females did not oviposit and considerably fewer eggs matured simultaneously.

The author concludes that *L. sticticalis* is not highly polyphagous, as its optimum food-plants comprise a small group of Chenopodiaceae. There is, however, a large range of plants on which its development is possible without loss of vitality.

[Nikol'skaya (M. N.).] **Никольская (М. Н.). The Chalcidoid Parasites (Hymenoptera) of some injurious Flies of the Grain Crops.** [*In Russian.*]—*Rev. ent. URSS* **27** pp. 3–27, 16 figs., 39 refs. Leningrad, 1937. (With a Summary in English.)

Descriptions are given of some 20 species of Chalcidoids parasitising Cecidomyiids and Chloropids on cereals in the Russian Union. The parasites are arranged in their families and genera, and keys to them are given, together with notes on their distribution, synonymy, hosts, and in some cases, bionomics. A list of the hosts with their parasites is appended.

[Larchenko (K. I.).] **Ларченко (К. И.). Le cycle évolutif du corps adipeux de *Loxostege sticticalis* L. et *Feltia segetum* Schiff. et sa relation avec la fécondité.** [*In Russian.*]—*Rev. ent. URSS* **27** pp. 29–75, 67 figs., 51 refs. Leningrad, 1937. (With a Summary in French.)

The main conclusions of this study of the relationship of the fat-body of larvae of *Loxostege sticticalis*, L., to the fecundity of the resultant adults have already been noticed from a summary [*R.A.E.*, A **25** 140]. Details are also given of the normal cycle of development of the

fat-body in *Euxoa* (*Feltia*) *segetum*, Schiff., but not of its effect on fecundity in this species.

[Kobakhidze (D. N.).] **Кобахидзе (Д. Н.). Boiökologie des *Pseudococcus gahani* Green.** [*In Russian.*]—*Rev. ent. URSS* **27** pp. 113–123, 2 figs., 5 refs. Leningrad, 1937. (With a Summary in German.)

Severe damage is caused to *Citrus* in the district of Sukhum (Abkhazia) by *Pseudococcus gahani*, Green [*cf. R.A.E.*, A **24** 675], all stages of which are described, and the fact that this mealybug can withstand temperatures ranging from —8°C. [17·6°F.] to 41–47°C. [105·8–116·6°F.] increases the danger of its spread to other districts. In the laboratory, the mean periods for the development of a generation on potato shoots were 66, 73 and 102 days at temperatures of 25·5°C. [77·9°F.], 20·4°C. [68·72°F.] and 18·3°C. [64·88°F.] and mean relative humidities of 81, 82·5 and 78·2 per cent., respectively. There are 3 generations a year in Sukhum, lasting 56–60, 70–80 and 180–220 days, respectively. The larvae of the third overwinter in cracks on the bark of the trees or on fallen leaves and weeds and migrate in spring to the leaves, young shoots, and flower-stems of *Citrus*, on which they complete their development. Sexually mature females do not feed, but migrate to tree trunks, dry leaves, or dry sheltered places near the tree, and oviposit. The young larvae appear from the end of May or beginning of June and congregate on the newly-formed fruits, attacking parts in proximity to other fruits and the leaves. Many of them, however, migrate to weeds. The larvae of the second and third generations appear at the end of July or beginning of August and the end of September, respectively, and mostly infest fruits, young shoots, leaves and weeds. *P. gahani* is very active until the beginning of oviposition, and migrates from one tree to another. In Sukhum, it has been recorded from 53 different food-plants, of which *Citrus* is the most severely injured.

In laboratory investigations on the effect of temperature on the fertility of the females, the oviposition period lasted only 3 days at 34·5°C. [94·1°F.] and a humidity of 58–63 per cent., as compared with 16–27 days at 7·8–14·4°C. [47·04–58·1°F.] and 50–98 per cent. humidity. No definite data were obtained as regards optimum conditions of temperature and humidity, but it appears that 19–26°C. [66·2–78·8°F.] and a humidity of 75–93 per cent. are favourable, the number of eggs laid increasing as the temperature rises. On the other hand, a constant temperature of over 30°C. [86°F.] combined with a relative humidity of less than 60 per cent. is detrimental. Field observations on the effect of different food-plants showed that the largest numbers of eggs were laid by females that had matured on *Citrus*, Japanese persimmon [*Diospyros kaki*] and cucurbits. Those of the overwintered generation were considerably more fertile than those of the other generations.

[Telenga (N. A.).] **Теленга (Н. А.). Beiträge zur Biologie der Braconiden (Hymenoptera).** [Contributions to the Biology of Braconids.] [*In Russian.*]—*Rev. ent. URSS* **27** pp. 125–127. Leningrad, 1937. (With a Summary in German.)

This is a list of 57 Braconids, arranged in subfamilies, that have been reared from insects in the Russian Union, showing their hosts and the dates and localities of the records.

[Vasil'ev (I. V.).] **Васильев (И. В.). Pear Bugs (Genus *Stephanitis*, Hemiptera-Heteroptera).** [*In Russian.*]—*Rev. ent. URSS* **27** pp. 129–138, 37 refs. Leningrad, 1937. (With a Summary in English.)

Much of this information on *Stephanitis pyri*, F., and *S. oschanini*, Vas., attacking pear and apple in the Russian Union has already been noticed from a summary [*R.A.E.*, A **24** 706]. Detailed descriptions are given of all stages of *S. pyri*, F., with characters distinguishing the two species. *S. oschanini*, which is confined to Central Asia, is found on apple much more often than on pear and occurs occasionally on poplar and elm.

Golfari (L.). **Contributi alla conoscenza dell'entomofauna del pero (*Pirus communis* L.). I.** [Contributions to the Knowledge of the Insect Fauna of the Pear.]—*Boll. Ist. Ent. Bologna* **9** pp. 206–249, 3 figs., 6 pls., many refs. Bologna, 30th May 1937.

In this paper are recorded in detail the author's observations in Central Italy on the bionomics of eight species of insects that infest pear and on the injury they cause, together with data from the more important literature on them. The pests concerned are *Stephanitis pyri*, F., *Psylla pyricola*, Först., the Aleurodid, *Siphoninus phillyreae*, Hal., the Buprestid, *Chalcophorella fabricii*, Rossi, *Anthonomus pomorum*, L., *A. piri*, Koll. (*cinctus*, Redt.), *Pristiphora* (*Micronematus*) *abbreviatus*, Htg., and *Caliroa limacina*, Retz. A considerable amount of information on the natural enemies of some of them is included. The most important of those attacking *S. pyri* was the Capsid, *Stethoconus cyrtopeltis*, Flor, others being the Anthocorids, *Orius* (*Triphleps*) *majusculus*, Reut., and *O.* (*T.*) *horvathi*, Reut., *Nabis* sp., and a Mymarid egg-parasite. Nymphs of *P. pyricola* were parasitised by various Hymenoptera, and preyed upon by the larvae of *Chrysopa perla*, L., and *Syrphus* (*Epistrophe*) *auricollis*, Mg. Those of *Siphoninus phillyreae* were parasitised by *Encarsia partenopea*, Masi, which was very common, and a species of *Prospaltella*, which was rare, and preyed upon by the Coccinellid, *Clitostethus arcuatus*, Rossi, and the larvae of a Drosophilid, *Acletoxenus formosus*, Lw. The larvae of *A. cinctus* were parasitised by a Pteromalid of the genus *Habrocytus*, the larvae of which are first endophagous and then ectophagous. The eggs of *C. limacina* were parasitised by a species of *Trichogramma* and a Mymarid of the genus *Gonatocerus* and the larvae by the Ichneumonid, *Pristomerus vulnerator*, Panz.

Couturier (A.). **Remarques sur une attaque de *Chortophila cilicrura* Rond. sur haricot.**—*Rev. Zool. agric.* **36** no. 3 pp. 33–36, 1 pl., 1 fig., 1 ref. Bordeaux, March 1937.

In the spring of 1936, first-generation larvae of *Phorbia* (*Chortophila*) *cilicrura*, Rond., were found attacking seedling beans in the Gironde [*R.A.E.*, A **25** 649]. In this area, it is usually the third-generation larvae that attract attention, owing to the injury that they cause to germinating winter wheat and other young cereals in autumn. They overwinter as pupae in the soil, and the adults first appear in April. Eggs are then laid in the soil, usually near crucifers, leeks or spring cereals, and the adults of this generation emerge in June. Those of the second generation may appear in July.

It is suggested that infestation of beans may be prevented by placing repellents such as paradichlorobenzene or naphthalene in the holes with the seeds when these are sown.

PARIS (P.). **Pullulation d'Acridiens en un point de la Vallée de la Saône.**—*Bull. Sci. Bourgogne* **6** (1936) pp. 87–89, 1 fig. Dijon, 1937.

In the summer of 1936, some high-lying fields of barley and oats between Seurre and Chivres in the Department of Côte d'Or, were severely damaged by Acridids of the genera *Mecostethus, Stenobothrus, Omocestus, Chorthippus* and *Oedipoda*, which were unusually numerous. Their dense aggregation within a small area was probably the result of the early floods of the Saône in 1935 having forced the preceding generation to oviposit on the higher ground in question.

The grasshoppers were preyed upon by rooks, starlings, *Tettigonia* (*Phasgonura*) *viridissima*, L., and *Decticus* (*Tettigonia*) *verrucivorus*, L., while *Chorthippus bicolor*, L., and *C. parallelus*, Zett., were infested by *Empusa grylli*.

CALLOT (J.). **Sur les parasites des sauterelles à Richelieu (Indre-et-Loire). II.**—*Ann. Paras. hum. comp.* **15** no. 3 p. 282, 3 refs. Paris, 1937.

In a previous communication [*R.A.E.*, A **23** 391], it was stated that various grasshoppers in Richelieu (Indre-et-Loire) were parasitised by larvae thought to be Conopids. These were not reared, but similar larvae obtained in August and September 1936 pupated almost immediately, and the adults emerged in March and April 1937. It then proved that the fly concerned was the Tachinid, *Acemya acuticornis*, Mg. [*cf.* **25** 9]. The grasshoppers parasitised by it in Richelieu were *Chorthippus dorsatus*, Zett., *C.* (*Stauroderus*) *mollis*, Charp., *C.* (*S.*) *bicolor*, L., *C.* (*S.*) *biguttulus*, L., *Euchorthippus pulvinatus*, F. W., and *Pezotettix giornai*, Rossi.

AUSTIN (M. D.) & PITCHER (R. S.). **Investigations on the Insect and allied Pests of cultivated Mushrooms.—X.** *Sciara varians* **Johns., its Occurrence within a Mushroom House, with a Description of the Male Genitalia.**—*J. S.-E. agric. Coll.* no. 40 p. 98, 1 fig., 1 ref. Wye, Kent, July 1937.

AUSTIN (M. D.). **XI. The Long-legged Mushroom Mite** (*Linopodes antennaepes* **Banks).**—*T.c.* pp. 115–118, 3 figs., 2 refs.

JARY (S. G.) & STAPLEY (J. H.). **IX.** *Tyroglyphus dimidiatus* **Herm.** (*longior*) **Gerv.**—*T.c.* pp. 119–129, 5 figs., 16 refs.

In the first paper, the male genitalia of *Sciara varians*, Joh., which has been taken on the inside walls of a mushroom house in England, are described to facilitate comparison with those of other species of the genus [*R.A.E.*, A **24** 682].

An account is given in the second paper of the occurrence in Kent of the mite, *Linopodes motatorius*, L. (*antennaepes*, Banks), which is briefly described, in mangel heaps, on the exposed tissue of cut mangels and particularly in the straw that covers them. In mushroom houses, it has been observed more frequently near hot water pipes, and it has been found in out-of-door beds also. It apparently prefers beds covered with straw or similar litter. In the United States, the

immature stages cause considerable injury to the mycelium of the mushroom, adults later attacking the bases of the stems [**20** 303]. It is highly probable that similar damage is caused in England. *L. motatorius* is often present, but apparently not abundant, in commercial mushroom houses. Damage attributed to it usually increases towards the end of the cropping period.

In the last paper, descriptions are given of all stages of *Tyroglyphus dimidiatus*, Herm., which is one of the commonest mites associated with cultivated mushrooms. At 22°C. [71·6°F.], the egg, larval, protonymphal and deutonymphal stages were completed in 5–6, 2–4, 3–4 and 4–7 days, while resting stages of larva, protonymph and deutonymph each lasted 1 day. Females laid 40–60 eggs and lived for as long as 3 weeks. Injury to mushrooms is similar to that by *Caloglyphus* (*T.*) *mycophagus*, Mégn.; small buttons are hollowed out until only a shell remains in which eggs and immature stages of the mites occur, and in larger mushrooms cavities of all sizes are eaten. Some emulsions containing petroleum oil kill the mites, but often cause distortion in the mushrooms. The removal of débris and the use of disinfectant when the houses are cleaned of beds is an important factor in control. Although *T. dimidiatus* is not very tolerant of moist conditions prevailing in manure heaps, its occurrence in straw, grain and similar material suggests that the stable manure used in the preparation of mushroom beds provides a source of infestation, as does also the straw used for covering the beds. Evidence is given to show that the elimination of old accumulations of manure may be related to a scarcity of *C. mycophagus*, and that infestations by *T. dimidiatus* mostly arise from sources other than manure. When absolutely fresh and well-wetted manure is used for the beds, mite infestations are rare.

Rolfe (S. W.). **Notes on Diplopoda IV. The Recognition of some Millipedes of economic Importance.**—*J. S.-E. agric. Coll.* no. 40 pp. 99–107, 21 figs., 5 refs. Wye, Kent, July 1937.

In this paper, which is one of a series [*R.A.E.*, A **22** 516], simple descriptions are given of the following millepedes, which are those most likely to occur as pests: the Polydesmids, *Polydesmus angustus*, Latzel, *P. coriaceus*, Porath, and *Brachydesmus superus mosellanus*, Verh.; the Strongylosomid, *Paradesmus gracilis*, C. L. Koch; the Iulids, *Cylindroiulus londinensis* var. *coeruleocinctus*, Wood, *C. britannicus*, Verh., *C. oweni*, Bollman, *Tachypodoiulus niger*, Leach, and *Ophyiulus pilosus*, Newp.; and the Blaniulids, *Blaniulus guttulatus*, Bosc, *Archiboreoiulus pallidus*, Brade-Birks, and *Choneiulus palmatus*, Němec. Of 130 cases of millepede damage recorded from 1923 to 1936 in England and Wales, 65 refer definitely to *B. guttulatus*, 7 to *P. angustus* and 3 to *C. londinensis* var. *coeruleocinctus*. The chief food-plants recorded are potato, *Brassica*, peas and beans, sugar-beet, strawberry fruit, cucumber and various garden and greenhouse flowers.

Jary (S. G.), Martin (J. T.) & Tattersfield (F.). **The Artificial Drying of Pyrethrum Flowers.**—*J. S.-E. agric. Coll.* no. 40 pp. 108–114, 1 fig., 11 refs. Wye, Kent, July 1937.

The following is the authors' summary: An experiment is described on the artificial drying of pyrethrum flowers at different temperatures.

The apparatus used is described, and the pyrethrin content of the kiln-dried flowers given for comparison with their air-dried controls.

There is a loss of pyrethrins in the sample dried at 45°C. (113°F.) for 21 hours and in those dried at 68°C. (154°F.) and 75°C. (167°F.) for 5¾ and 3½ hours, respectively. There is little or no loss of pyrethrins in samples dried at temperatures of 52°C. (126°F.) and 60°C. (140°F.) when comparisons are made with their air-dried controls.

JARY (S. G.). **A Note on** *Tyroglyphus longior* **var.** *castellanii* **(Hirst).**—*J. S.-E. agric. Coll.* no. 40 p. 130. Wye, Kent, July 1937.

The characters that distinguish *Tyroglyphus dimidiatus*, Herm. (*longior*, Gerv.) and its variety *castellanii*, Hirst, are enumerated, and it is shown that there are intermediate gradations between the extreme forms. Mites that appear to be var. *castellanii* have been examined from Hertfordshire, Kent, Norfolk and Yorkshire, where they occurred on mushrooms in association with typical *T. dimidiatus* and some of the intermediate forms.

JARY (S. G.). **The Identity of** *Tyroglyphus siro* **L. (Gerv.).**—*J. S.-E. agric. Coll.* no. 40 pp. 131–133, 6 refs. Wye, Kent, July 1937.

Although the mite *Tyroglyphus siro*, L., is principally found on cheese and possibly occasionally on grain, it is not the most common *Tyroglyphus* on cheese, and appears frequently to have been confused with *T. dimidiatus*, Herm. (*longior*, Gerv.), which is polyphagous and very widely distributed. Characters that differentiate the two species are therefore enumerated.

JARY (S. G.). **Tests of Insecticides against** *Anthonomus rubi* **(Herbst).**—*J. S.-E. agric. Coll.* no. 40 pp. 134–147, 23 refs. Wye, Kent, July 1937.

A brief review is given from the literature of previous work on the use of insecticides for the control of *Anthonomus* spp., and particularly *A. rubi*, Hbst., on strawberry. In experiments against the latter carried out in England from 1933 to 1935, insecticides were tested in cages containing potted strawberries on overwintered weevils taken in the field in May and on young ones bred from infested buds collected in June from round the base of infested plants. Dusts were applied sparingly so as not to give more than the minimum coverage necessary. Dusts containing derris did not appear to give a rapid or high mortality, and those with a rotenone content of 0·5 per cent. or less were not appreciably inferior to pure ground derris. Pyrethrum dusts and sprays did not differ markedly in effect from rotenone-containing preparations and were slightly less toxic. A dust of pure barium fluosilicate showed a considerable degree of toxicity, but when the proportion of fluosilicate was reduced the effect was diminished. Calcium arsenate dusts of relatively low As_2O_5 content showed a slight but probably definite toxicity. In Canada, arsenical dusts have been used for the control of *A. signatus*, Say, on strawberries [**24** 502], but such dusts should not be applied after the blossoms are open. A dust of higher As_2O_5 content might be used after fruit is picked for the control of newly-emerged weevils. Promising results were obtained at this time by the use of a syrup consisting of 1 lb.

glycerine and 2 lb. sugar in 4 gals. water, poisoned with 4 oz. sodium arsenite. This was applied in droplets on the leaves and caused some injury to young foliage and the crowns of the plants, but in practice such injury should be slight as the amount of liquid used per acre would be small. When 0·01 or 0·005 per cent. rotenone was substituted for the sodium arsenite, the syrup was not effective.

KEARNS (H. G. H.) & MARSH (R. W.). **A Summary of Fruit Spraying Programmes.—I.**—*Rep. agric. hort. Res. Sta. Bristol 1936* pp. 75–89, 24 refs. Bristol [1937].

This is a summary of standard spray programmes for the control of insect pests and diseases of fruit trees and small fruits in commercial orchards in south-western England. Specifications are given for the different materials, and directions for modifying the sprays according to the varieties treated and the intensity of attack by different pests.

KEARNS (H. G. H.) & UMPLEBY (E.). **The Control of the Insect Pests of Nursery Fruit Stock.**—*Rep. agric. hort. Res. Sta. Bristol 1936* pp. 90–98, 5 refs. Bristol [1937].

Recommendations are given for the control of insect pests of nursery stock of fruit trees and small fruits in south-western England. It is important to carry out preventive routine spraying and to use more rigorous measures than for established fruit plantations. Brief notes on soil pests are included.

KEARNS (H. G. H.), MARSH (R. W.) & MARTIN (H.). **Combined Washes. Progress Report.—III.**—*Rep. agric. hort. Res. Sta. Bristol 1936* pp. 99–117, 5 refs. Bristol [1937].

In continuation of previous field trials in south-western England [*cf. R.A.E.*, A **24** 685], a highly refined petroleum oil having an unsulphonated residue of 98 per cent. by volume was emulsified with a 20 per cent. solution of sulphite lye and applied to apple trees in some or all of 4 sprays containing lime-sulphur against apple scab in different parts of the country. In most cases the percentages of emulsion (containing 66·7 per cent. oil) were 7·5, 4·5, 1·5 and 1·5 in the green flower, pink bud, petal fall and " three weeks " sprays, respectively. Results showed that the combination was in general safe for apple varieties tolerant of sulphur, and though serious defoliation was reported in one trial in which the oil was included in all scab sprays, the yield of crop was not affected. The combination can be recommended for general use in circumstances when it can economically replace the separate insecticide and fungicide applications. The addition of the emulsion does not improve the fungicidal efficiency of the lime-sulphur.

Experiments were carried out to determine the phytocidal effect of semi-refined petroleum oils applied at a concentration of 5 per cent. oil in 3·5 per cent. lime-sulphur sprays. The characteristics of those tested are given in a table, their unsulphonated residues being 74, 77·5 and 78 per cent. by volume, while that of the highly refined oil with which they were compared was 98 per cent. Within a week of application, very severe injury had been caused to apple foliage and flower buds by the first, and to buds in the pink bud stage by the

second and third, many of the buds in the green flower stage escaping injury. By the end of the summer there was, however, little evidence of injury other than a reduction of crop on the injured trees. Damage was negligible on trees sprayed with the refined oil alone, or in combination with lime-sulphur, and it was slightly less than that on the trees sprayed with lime-sulphur only. In similar experiments with black currants, the second semi-refined oil, both alone and combined with lime-sulphur, considerably checked the growth of foliage and injured the flower racemes. The refined oil alone, and combined with lime-sulphur, caused some damage, but not more than that caused by the lime-sulphur alone.

Tests of sprays against the apple sawfly [*Hoplocampa testudinea*, Klug] were carried out with particular reference to the value of different spreaders (penetrants) for insecticides containing rotenone. All sprays were combined with 1 per cent. lime-sulphur. The insecticides used were nicotine, ground derris root yielding 1·0 per cent. rotenone and 10·5 per cent. ether extract, barbasco [*Lonchocarpus*] root yielding 5·6 per cent. rotenone and 17·0 per cent. ether extract, and a derris extract containing 20·1 per cent. pure rotenone. For the preparation of sprays, 2·6 oz. of this extract was dissolved in 13 fl. oz. carbitol (diethylene glycol monoethyl ether), slight heating being necessary just before use, and the solution added to the concentrated spreader in 2 gals. water, the whole then being added to the bulk of the diluted lime-sulphur in the spray tank. The spreaders used were sulphonated lorol, Agral 2 and gamma sulphonates (in the form of a 20 per cent. solution of the sodium salts), all at a concentration of 0·05 per cent., sulphite lye at 0·75 per cent., and an emulsion of Grade G petroleum oil (prepared with sulphite lye and containing 66·7 per cent. oil) at 1 per cent. The sprays were applied on 29th May, about 4 days before the sawfly eggs hatched, and the fruits were examined on 3rd July. With sprays containing sulphonated lorol alone and with 0·05 per cent. nicotine, 0·25 per cent. derris root, 0·1 per cent. derris root, 0·1 per cent. barbasco root, and 0·016 per cent. derris extract, the mean percentages of infested fruits were 65·3, 16·7, 15·9, 39·8, 23·8 and 24·2; and with sprays containing 0·016 per cent. derris extract with Agral 2, gamma sulphonates, sulphite lye and oil emulsion, they were 23·9, 34·0, 39·2 and 6·8. Although the oil emulsion was superior to the water-soluble spreaders, the difference cannot be ascribed wholly to its efficiency as a spreader, as rotenone is more soluble in petroleum oil than in water. Counts show that the number of fruitlets was less on the trees treated with the oil emulsion, but it is not yet known whether this is due to the phytocidal action of the spray. The results of these trials suggest that rotenone-containing material is an effective insecticide for comparative studies on wetters and spreaders provided that the concentration of rotenone is adequate to give an effective duration of toxicity over the period between the application of the wash and hatching of the eggs.

Experiments were also carried out against *Hoplocampa flava*, L., on plum. Sprays of 0·016 per cent. derris extract with 0·05 per cent. sulphonated lorol or with 1 per cent. Grade G petroleum oil emulsion reduced the percentage of infested plums from 43·86 to 15·45 and 4·23, respectively, when applied on 18th May, and to 2·64 and 1·05 when applied on both 18th and 25th May, the fruit being examined on 19th June. The efficiency of the oil as a spreader was confirmed by

further tests of single applications of sprays containing the 1 per cent. emulsion with 0·1 per cent. barbasco root or 0·25 per cent. derris root, both sprays giving a high degree of control.

KEARNS (H. G. H.) & MARTIN (H.). **The Use of Sulphite Lye as an Emulsifier.**—*Rep. agric. hort. Res. Sta. Bristol 1936* pp. 118–123, 5 refs. Bristol [1937].

Sulphite lye, also known as sulphite cellulose lye, lignin pitch, goulac, etc., is a waste product from wood pulp manufacture by the sulphite process, concentrated to a thick syrup or to a solid. As it is a suitable emulsifier for petroleum oil emulsions to be used in combined sprays, details are given of the preparation of these emulsions by a method that provides, on a small scale, the conditions likely to be met in factory manufacture. Brief notes are also given on the use of sulphite lye for emulsification of tar oils and organic thiocyanates.

SWARBRICK (T.) & BERRY (W. E.). **Further Observations on the Incidence and Spread of Reversion and Big Bud in Black Currants.**—*Rep. agric. hort. Res. Sta. Bristol 1936* pp. 124–132, 1 pl., 9 refs. Bristol [1937].

From 1927 to 1935, a study was carried out in south-western England on the incidence and spread of reversion in black currants and its relation to the big-bud mite, *Eriophyes ribis*, Nal. [*cf. R.A.E.*, A **15** 482]. The observations were made in a large experimental plantation, throughout which reverted bushes had been planted at intervals; all the bushes were given routine applications of a tar distillate wash in winter, lime-sulphur in spring and Bordeaux mixture in late summer, except in 1932, biting and sucking insects being effectively controlled.

A preliminary report, covering the first 4 years, has already been noticed [**20** 550]; the incidence of big-bud had then been negligible. During the whole period, there were 53 cases of big-bud, 48 occurring on reverted bushes, but on 47 other reverted bushes no obvious symptoms of big-bud were found. In most cases where both occurred on the same bush, reversion was recorded 2–3 seasons before big-bud appeared, but on 7 bushes both appeared in the same year. In no cases did big-bud precede reversion. The incidence of reversion was greater in the vicinity of previous sources of infection, and it also showed a tendency to spread in a north-westerly direction. It was impossible to decide whether this was due to the distribution of susceptible varieties of black currant, or to the frequency of easterly and south-easterly winds in late February, March and early April, when the mites are migrating. Some of the evidence suggests that bushes may become infested with mites for several seasons before the usual big-bud symptoms appear, and that the mites may be present in considerable numbers without building up the large population necessary to produce the typical big-buds regarded as the criterion of infestation. Heavy populations of mites are known to occur on red currants without the production of big-buds. It is concluded that the evidence points to the possibility that many new cases of reversion arise through the activities of the mite; but other means of spreading the disease are not precluded, and it is possible that some of the bushes had the disease in a mild form when planted and developed symptoms later.

Swarbrick (T.). **The Effect of Spraying Methods upon the Cost of applying Fruit Tree Washes.**—*Rep. agric. hort. Res. Sta. Bristol 1936* pp. 160–190, 1 ref. Bristol [1937].

This paper is based upon eight consecutive seasons' work at Long Ashton. The particular aspect of spraying costs discussed is that of the cost of making a spray application with different types of machinery, the total cost of spraying not being considered.

Pescott (R. T. M.). **The Leaf-eating Ladybird** (*Epilachna vigintioctopunctata* **Fab.**).—*J. Dep. Agric. Vict.* **35** pt. 6 pp. 290–292, 7 figs., 2 refs. Melbourne, June 1937.

Much of the information given on *Epilachna vigintioctopunctata*, F., which was recorded for the first time in Victoria in 1935, has already been noticed [*R.A.E.*, A **16** 631]. It has only been found in the extreme east of the State, where it severely damaged, and in some cases stripped, potatoes. Feeding appeared to be restricted to solanaceous plants, including tomato. There were two generations in the year. The winter was apparently passed in the adult stage at the base of shrubs, under loose bark of trees or under wild food-plants, and oviposition began in early spring as soon as potato plants were available. Eggs were laid in clusters of 6 to 50, on the lower surface of the foliage. The egg, larval and pupal stages lasted 4 days, 4–6 weeks and 7–10 days, respectively. Pupation normally took place at the base of the food-plant, to which the pupa was firmly attached at soil level. The adults fly only a little in sunny weather, and in dull or cold weather appear to become quite dormant. A female may lay 100 to 250 eggs, oviposition being extended over many weeks.

Successful control was obtained with a dust containing 25 per cent. lead arsenate against the older larvae and adults and 2 per cent. nicotine against the young larvae, applied as soon as infestation was noticed.

Uichanco (L. B.) & Gines (R. B.). **A biometrical Study of the adult Components of Philippine Locust Swarms.**—*Philip. Agric.* **26** no. 3 pp. 237–289, 10 charts, 11 refs. Laguna, August 1937.

A detailed biometrical study was made of over 19,000 specimens of *Locusta migratoria manilensis*, Meyen [*cf. R.A.E.*, A **24** 233] collected from swarms on the islands of Luzon, Visayas and Mindanao during the outbreak of 1932–36. The value of the ratios of different parts of the body to one another for the study of variations is discussed; the ratio of the length of tegmen over that of the femur, which varies with the latter, was found to be the most useful.

There was no noticeable difference in the composition of the swarms from areas where the invasions are the least frequent and from those lying west of the line from Davao Gulf through Agusan, Leyte and Bicol Peninsula, where they occur most often [*cf.* **25** 125]. Moreover, the composition of the swarms was most variable during the months of maximum infestation, which coincides with the summer rainy season, and not at the beginning and the end of the maximum periods. It is suggested, therefore, that transformation of ph. *solitaria* into ph. *gregaria* and *vice versa* [*cf.* **18** 55] does not occur in the Philippines, where ph. *solitaria* could not exist in the permanent locust reservations,

such as are found in Mindanao, owing to the almost perennial presence there of the swarms. The females apparently contain eggs giving rise to different phases, and the survival of particular types of eggs and consequently the nature of the progeny are determined by the environmental factors acting on the parents.

It is unlikely that the increase of grassland as the result of shifting cultivation [*cf.* **24** 233] is responsible for locust outbreaks in the Philippines, for these occurred even before the Spanish conquest [**24** 810] and the subsequent increases of the population and deforested areas. Moreover, the locust reservations are found on the islands of Mindanao and Sulu, where the percentage of grasslands is the smallest for the Archipelago.

Nixon (G. E. J.). **New Asiatic Telenominae (Hym., Proctotrupoidea).**—*Ann. Mag. nat. Hist.* (10) **20** no. 115 pp. 113–127, 5 figs. London, July 1937.

The author discusses the status and scope, as interpreted by various workers, of the genera *Telenomus*, *Phanurus* and *Microphanurus*, to which the majority of the species of Telenominae belong. He recognises two genera, *Telenomus* (for the species with hairy eyes) and *Microphanurus* (for those with bare eyes), considering *Phanurus* as a synonym, and *Aholcus* (*Neotelenomus*) as a subgenus, of *Telenomus*.

Descriptions are given of 7 new species of *Telenomus* (*Aholcus*) reared from eggs of various Lepidoptera in Malaya and Ceylon.

Esaki (T.). **Insects injurious to Cucurbits in Mandated South Sea Islands of Japan. First Report.** [*In Japanese.*]—*Akitu* **1** no. 1 pp. 1–6, 2 pls., 2 figs. Kyoto, June 1937.

The insects recorded include *Leptoglossus membranaceus*, F., on pumpkin, watermelon and cucumber in Saipan, Tinian and Rota (Marianna Islands); *Aphis gossypii*, Glov., on watermelon in Saipan; and *Ceratia* (*Aulacophora*) *similis*, Ol., and *C.* (*A.*) *flavomarginata*, Duv., on various cucurbits in the Palau Islands.

Yago (M.). **The Cicada in Pear Orchards. Ecological Notes and the Methods of controlling the Cicada, *Graptopsaltria nigrofuscata* Motsch. (syn. *G. colorata* Stål). Second Report.**—*Bull. agric. Exp. Sta. Shizuoka* no. 41, 13 pp., 12 figs. Shizuoka, February 1937.

An account is given of further observations on *Graptopsaltria nigrofuscata*, Motsch. (*colorata*, Stål) in pear orchards in the Shizuoka Prefecture [*cf. R.A.E.*, A **24** 320]. In addition to pear and other fruit trees, the adults feed on elm, *Podocarpus*, pine, *Celtis*, camphor, *Wistaria* and maple, and the nymphs, which are described, on the roots of *Cryptomeria japonica*, cabbage, *Vicia* and onion. The eggs hatch from late June to late July, generally after rainfall; those in a single mass hatch over a period of about 3 weeks. The ant, *Paratrechina flavipes*, Smith, is sometimes predacious on the young nymphs, and the adults are killed by *Vespa insularis*, D. T. (*japonica*, Smith), lizards and a fungus (*Isaria*). In experiments, sodium cyanide solution sprayed on shallowly ploughed ground killed 32·6 per cent. of the nymphs. Carbon bisulphide poured into holes in the soil killed 98·4 per cent., but injured the pear trees. Covering the tree trunks

with newspaper prevented oviposition ; washing them with creosote or coal tar was effective in killing the eggs, but did not prevent oviposition.

YAGO (M.). **Studies on the Pear Leaf-roller,** *Cacoecia xylosteana* **L. Second Report.** [*In Japanese.*]—*Bull. agric. Exp. Sta. Shizuoka* no. 42, 16 pp., 4 pls. Shizuoka, March 1937.

Further information is given on the bionomics of the leaf-roller, *Tortrix* (*Cacoecia*) *xylosteana*, L., on pear in Japan [*cf. R.A.E.*, A **20** 379 ; **25** 230], and all the larval instars are described. Under experimental conditions, the larvae were highly polyphagous. The larval stage lasted 31–40 days, and the pupal stage 9–12. The moths were caught at lights for 11–34 days in May and June ; they had a pre-oviposition period of 1–7 days. The Encyrtid, *Neocopidosoma komabae*, Ishii, the Chalcid, *Brachymeria obscurata*, Wlk., and other parasites attack the larvae, but are not common, and *Trichogramma* sp. and two undetermined Chalcidoids parasitise the eggs.

YAGO (M.) & FURUKORI (N.). **Studies on the Pear Tetranychid Mite,** *Tetranychus* **sp.** [*In Japanese.*]—*Bull. agric. Exp. Sta. Shizuoka* no. 43, 30 pp., 3 pls. Shizuoka, March 1937.

A mite of the genus *Tetranychus*, all stages of which are described, causes serious damage to pear in the Shizuoka Prefecture, attacking particularly the undersides of leaves and sometimes the fruit. The winter eggs are deposited in crevices in the bark and hatch from late April to early May, and about 10 generations are produced up to October, the mite being most numerous in July–August. It develops to the adult stage in 4–11 days, moulting 3 times, and a female lays about 20 eggs. In captivity, the mites also fed on peach, plum, cherry, elm, fig and egg-plant. Natural enemies include *Scymnus* sp., *Osmylus* sp., the Staphylinid, *Oligota oviformis*, Casey, and a Cecidomyiid. Lime-sulphur gives good control, but is liable to injure the trees ; derris and sulphur are effective during the early part of the year.

HORI (M.). **Notes on the original Host Plants of injurious Insects in Sakhalin.** [*In Japanese.*]—*Kontyû* **11** no. 3 pp. 233–237. Tokyo, May 1937.

A list is given of 23 insects injurious to crops in Sakhalin, with their wild food-plants. They include *Hylemyia flavopicta*, Mats., on wild as well as cultivated crucifers ; *Phytomyza affinis*, Fall. (*nigricornis*, Macq.), on *Neslia paniculata* and *Taraxacum vulgare*, as well as peas and cruciferous vegetables ; *Galerucella rubi*, Tamanuki, on roses, *Rubus*, *Geum*, etc., as well as strawberry ; *Cassida nebulosa*, L., on *Chenopodium* and beet ; *Vanessa io geisha*, Stich., on nettle (*Urtica takedana*) and hops ; and *Aporia crataegi adherbal*, Fruhst., on hawthorn (*Crataegus chlorosarca*) and apple.

KUROSAWA (M.). **Descriptions of four new Thrips from Japan.**—*Kontyû* **11** no. 3 pp. 266–275, 1 pl., 2 figs. Tokyo, May 1937.

The new species described include *Haplothrips* (*Hindsiana*) *odonaspicola*, taken in association with the Coccid, *Odonaspis secreta*, Ckll., on bamboo in Japan, and *Frankliniella lilivora*, infesting lily-bulbs in Japan, Korea, Manchuria and China.

Ono (K.). **On** *Chrysomela aurichalcea* **Mannerh.** [*In Japanese.*]—*Insect World* **41** no. 8 pp. 298–301. Gifu, Japan, August 1937.

In Japan, *Chrysomela aurichalcea*, Mannerh., attacks *Chrysanthemum*, *Petasites japonicus* and *Artemisia* and has one generation a year, passing the summer in the adult stage. The eggs are laid on the leaves or petioles in small masses from early November to late January. The larvae hatch in 60–100 days and pupate in the second half of April or early May in the soil, the adults emerging 10 days later.

Jewett (H. H.). **Control of Insects commonly affecting Tobacco Plant Beds.**—*Circ. Ky agric. Exp. Sta.* no. 47, pp. 11–23, 7 figs., 6 refs. Lexington, Ky, February 1937. [Recd. August 1937.]

In 1934, experiments were begun in Kentucky on the control of insect pests of young tobacco plants in beds. To determine the measure of control of white grubs effected by burning or steaming a bed, larvae were placed at different depths in the soil just before treatment and removed as soon as the soil had cooled. In one test, grubs placed in batches of 25 at depths of 4, 6, 8 and 10 ins. in the soil were all killed after steam had been applied for 30 mins. at 80 lb. pressure. After burning the beds, most of the larvae down to a depth of 4 ins. were killed. In 1935, larvae of the green June beetle [*Cotinis nitida*, L.] were numerous in the soil of several beds. In one bed, carbon bisulphide was applied at a maximum rate of 1·5 oz. per sq. yd. by injecting it into holes (either made by the larvae or with rods), which were afterwards closed. Only 3·3 per cent. of the larvae subsequently examined showed any signs of activity, and the plants were not injured. A diluted carbon bisulphide emulsion containing 1·4 quarts carbon bisulphide in 100 gals. water, applied with a hose at the rate of 2 U.S. gals. per sq. yd., only killed 30 per cent. of the larvae and injured many plants. In other experiments, several large trays were filled with soil that had been passed through a sieve, and 15–20 larvae placed in each. The larvae immediately burrowed. When a bait of 25 lb. bran and 1 lb. Paris green moistened with water [*R.A.E.*, A **14** 487] was applied to the surface at rates of 4, 5 and 6 lb. dry weight to 100 sq. yds., the percentages of larvae killed were 8–24, 10–30 and 40–65, respectively.

An infestation by *Bourletiella hortensis*, Fitch, was controlled by a spray containing nicotine sulphate (1 : 800) applied at the rate of 5 U.S. gals. to 30 sq. yds. of bed. About 97·9 per cent. of the springtails were killed. Methods for the control of *Epitrix parvula*, F., on tobacco are reviewed [**21** 73, 245; **23** 530; **24** 28]. Comparative tests of the effect against it of insecticides and of enclosing parts of the beds with board frames tightly covered with a good tobacco cloth were carried out from 1934 to 1936. Sprays were applied at the rate of 1 U.S. gal. to 30 sq. yds and dusts at the rate of ½ lb. to 100 sq. yds., except in the case of derris dusts, of which 1 lb. was used. The best protection was given by the covered frames, the percentage of injured plants varying from 1·5 to 5·0 in the 3 years. The soil should be banked up on the outside of the board and made firm. A dust containing 80 per cent. barium fluosilicate was the most effective insecticide, 12·7–15·5 per cent. of the plants being injured. Sprays containing 50 U.S. gals. Bordeaux mixture (3 : 3 : 50) and 2 lb. lead arsenate, alone or with 1 U.S. pt. nicotine sulphate, both reduced injury insufficiently. Derris dusts of 1 or 2 per cent. rotenone content killed

the beetles, but gave little control unless applied frequently. Other insecticides included a dust of Paris green, lead arsenate and hydrated lime (1 : 4 : 1), which gave fair control; and a spray of 2½ lb. cuprous cyanide in 100 U.S. gals. water, which gave poor control.

PIEMEISEL (R. L.) & CHAMBERLIN (J. C.). **Land-improvement Measures in Relation to a possible Control of the Beet Leafhopper and Curly Top.**—*Circ. U.S. Dep. Agric.* no. 416, 23 pp., 13 figs., 6 refs. Washington, D.C., December 1936. [Recd. August 1937.]

The following is based on the authors' summary of observations in southern Idaho: *Eutettix tenellus*, Bak., which is the vector of the curly-top of sugar-beet, beans, tomatos and other cultivated crops, is produced in economic numbers only on the stands of weeds that grow on abandoned, weedy fallow and on burned-over or heavily grazed lands and of which different species are important food-plants both in the winter and spring, and in the summer. Well farmed lands and desert range in good condition do not produce economically significant numbers of this leafhopper. Under favourable and natural conditions, these weeds will ultimately be replaced by a combination of desert shrubs, perennial grasses and other plants on which it does not breed [*cf. R.A.E.*, A **20** 725]. In the greater part of southern Idaho complete re-establishment of native perennials is not necessary for the elimination of weed food-plants, since downy chess (*Bromus tectorum*), which is not a food-plant, forms an intermediate stage. In favourable situations, the replacement of weed food-plants by downy chess takes place in about 5 years. The beet leafhopper can therefore be controlled provided that all lands not continuously farmed and well farmed can be restored to and maintained as good desert range. The measures proposed to accomplish this are similar to those employed for land conservation and may be applied in all States where a similar problem exists.

The portion of southern Idaho considered in this paper is divided into three categories; areas where weeds are abundant; overgrazed sagebrush lands, where summer food-plants are usually absent, and high populations of the leafhopper are built up in the spring; and areas where the weeds have already been practically eliminated by natural recovery.

FRANKLIN (H. J.). **The Cranberry Station, East Wareham, Massachusetts.** –*Bull. Mass. agric. Exp. Sta.* no. 339 (Ann. Rep. 1936) pp. 36–40, 3 refs. Amherst, Mass., March 1937. [Recd. August 1937].

The bulk of this report deals with insects injurious to cranberry in Massachusetts during 1936. Larvae of *Phigalia titea*, Cram. (half-winged geometer) are often fairly abundant on dry cranberry bogs in late May and early June, but no very serious outbreak has been observed. Other food-plants include apple, blackberry, blueberry, cherry and rose. In the laboratory, adults emerged from late March to mid-April. Late summer, autumn and winter are passed in the pupal stage. The distribution of the species appears to extend as far as Minnesota, Virginia and Canada. In one locality cranberries near grape vines were injured by larvae of the Rutelid, *Anomala errans*, F.

In tests of insecticides against cranberry insects, all derris powder employed in sprays contained 4 per cent. rotenone; amounts of

insecticides are given per 100 U.S. gals. *Cryptocephalus incertus*, Ol., (fire-beetle) was abundant on cranberries in 1936. A spray containing 6 lb. lead arsenate, applied at the rate of 250 U.S. gals. per acre in early September, killed 99 per cent. of the beetles ; one of 10 lb. derris and 3 lb. fish-oil soap, applied at the rate of 400 U.S. gals. per acre, killed 90 per cent. Adults are present on cranberries from early August to late October and attack both surfaces of the leaves. Oviposition occurs throughout September. *C. incertus* is abundant in Florida and also infests wax myrtle (*Myrica cerifera*), huckleberry and fetter bush (*Lyonia nitida*). A single application of undiluted pyrethrum dust (1·6 per cent. pyrethrin content) at the rate of 100 lb. per acre appeared to be effective against *Anthonomus musculus*, Say (cranberry weevil), but the experiment was not duplicated. This dust was not satisfactory at the rate of 50 lb. per acre, and poor results were also given by sprays of kerosene (100 U.S. gals. per acre in mid-June) and derris (8 lb.) with fish-oil soap (4 lb.) at the rate of 400 U.S. gals. per acre, and by derris dust containing 1 per cent. rotenone applied at the rate of 100 lb. per acre. A spray of Bordeaux mixture, calcium arsenate and soap is effective against *A. musculus* and *Systena frontalis*, F. (cranberry flea-beetle), but it cannot be applied with safety at the time that it would be most useful against the latter, as residues would remain on the fruit. Adults of *S. frontalis* were controlled in August by a dust of undiluted pyrethrum (0·9 per cent. pyrethrin content) applied at the rate of 100 lb. per acre or by a spray containing 10 lb. derris with 1 lb. Areskap at the rate of 400 U.S. gals. per acre. Adults of *Amphicoma vulpina*, Hentz, occurred in mid-July, and larvae damaged cranberry in the same area. A spray containing 8 lb. derris with 3 lb. fish-oil soap was effective against nymphs of the cranberry spittle insect (*Clastoptera*), but 5 lb. derris with 4 lb. fish-oil soap was not satisfactory, nor was 200 U.S. gals. water-white kerosene per acre. For the control of *Lymantria* (*Porthetria*) [*dispar*, L.], which was abundant during the year, sprays of derris (4 or 6 lb.) with fish-oil soap (4 lb.) at the rate of 400 U.S. gals per acre killed 40 and 75 per cent. of the larvae respectively. The blackheaded fireworm, *Rhopobota* [*naevana*, Hb.], was less common than usual. Sprays of derris, fish-oil soap (5 or 6 lb. with 4 lb. and 8 lb. with 3 lb.) at the rate of 400 U.S. gals. per acre killed 75, 85 and 98 per cent. of the larvae but are too expensive to use against this pest. *Mineola vaccinii*, Riley (cranberry fruitworm), caused some injury, but less than in 1935. Three applications in late June and July of a dust of undiluted pyrethrum (0·9 per cent. pyrethrin content) at the rate of 100 lb. per acre reduced the damage considerably, but did not eliminate it. A spray of derris and fish-oil soap gave fairly good control and did not injure the crop or the foliage. In experiments with mixtures of kerosene and pyrethrum extract applied as mist sprays, 80 per cent. of the blunt-nosed leafhopper (*Ophiola*) were killed, but control of *Anthonomus musculus* and *R. naevana* was not satisfactory. This type of spray is less effective and less easily applied than a pyrethrum dust.

Bourne (A. I.) & others. **Department of Entomology.**—*Bull. Mass. agric. Exp. Sta.* no. 339 (Ann. Rep. 1936) pp. 46–61. Amherst, Mass., March 1937.

This report presents results of experiments at Massachusetts that were not sufficiently conclusive for separate publication.

A proprietary miscible oil mixture containing 95 per cent. petroleum oil, 4 per cent. cresol compounds and 1 per cent. inert compounds (chiefly water), used at a dilution of 3½ per cent., gave 98 per cent. control of overwintering eggs of the European red mite [*Paratetranychus pilosus*, C. & F.] on fruit trees. In tests against the gladiolus thrips [*Taeniothrips simplex*, Morison], sprays containing derris were superior to those containing a thiocyanate compound (Lethane 420) when applied at dilutions of 1 : 600 four times at weekly intervals immediately the infestation began to develop. No spray will give satisfactory control if application is delayed until infestation is heavy. In two experiments from January to May, certain proprietary sprays containing pyrethrum, applied at intervals of about 10 days, gave good control of the greenhouse leaf-tier [*Phlyctaenia rubigalis*, Gn.] on snapdragon [*Antirrhinum*] in greenhouses, and a derris extract containing 1½ per cent. rotenone was also effective. Unsatisfactory results were obtained with a spray of derris powder (2 and 3 lb. in 50 U.S. gals. water), and by derris and pyrethrum dusts, which left noticeable residues on the plants.

One treatment with mercury bichloride solution (1 oz. in 10 U.S. gals. water) as soon as the eggs were observed gave good control of the larvae of the cabbage fly [*Phorbia brassicae*, Bch.] on cabbage. A dust of pure mercurous chloride (calomel) shaken on the roots of seedlings when they were transplanted [*cf. R.A.E.*, A **24** 491] protected 88 per cent. of the plants ; if the dust was mixed with inert clay in the proportion of 1 : 1 and 1 : 3, 60 and 42 per cent., respectively, of the plants were protected. Mercurous chloride mixed with laundry starch, clay, and clay with fish oil in proportions of 1 : 1, 1 : 3 and 1 : 9 with sufficient water to make a thick paste gave 76–96 per cent. protection if smeared on the roots and lower stems of the plants. The addition of fish oil did not increase the effectiveness of the clay mixture. There was no significant difference between the mixtures in 1 : 1 and 1 : 3 ratio, but the 1 : 9 ratio was generally less effective in all the mixtures. Mixtures of mercurous chloride with calcium caseinate, lead arsenate with sulphur (15 : 85), and lead arsenate with lime (20 : 80), in paste form, caused serious injury to the seedlings and killed many of them. All of the pastes checked the growth of the seedlings slightly by matting the roots together. The most effective treatment against the squash vine borer [*Melittia satyriformis*, Hb.], which was less abundant than usual on squash in the field, was a spray containing 5 lb. cubé powder with 1 U.S. qt. fish-oil soap in 100 U.S. gals. water, which reduced injury by 74 per cent. A spray of nicotine sulphate (1 : 500) with 1 per cent. summer oil was again superior to nicotine sulphate (1 : 250) [*cf.* **23** 654]. Dusts were less effective than in 1935 [**24** 491]. The onion thrips [*Thrips tabaci*, Lind.] appeared at about the same time and in the same abundance in fields that were submerged under several feet of water in March and in others above flood level. The peak of abundance occurred from 27th July to 1st August, when there was an average of 40 thrips on each onion plant. In a light infestation on experimental plots, no spray gave as good an immediate effect as nicotine sulphate and soap. A combination of nicotine and oil, which was slow in becoming effective, gave the greatest protection against re-infestation. Rotenone compounds had a pronounced residual effect over a week's interval.

Spray residues on apples that had received regular sprays of lead arsenate up to and including the third cover spray on 13th July exceeded the legal limit. Dusts should be used instead of the third and fourth cover sprays, as they are effective against the apple maggot [*Rhagoletis pomonella*, Walsh], against which these sprays are chiefly directed, and may be applied within 3 weeks of harvest. When compared with lead arsenate on apple, a proprietary brand of calcium arsenate, with the addition of a colloidal spreader, gave substantially as satisfactory control of the plum curculio [*Conotrachelus nenuphar*, Hbst.] and codling moth [*Cydia pomonella*, L.], as did also a basic zinc arsenate used after the first cover spray. No injury was caused to fruit or foliage. In 1936, 25 per cent. of the hibernating adults of *C. nenuphar* had come to the apple trees before the application of the first calyx spray; the weevils were most active on 23rd–25th May and 1st–4th June. Six sprays of lead arsenate and fish oil were applied, at intervals of 3 days, from 20th May to 4th June. The most effective treatment was that applied just before the first period of abundance, and the least effective applications were those immediately after the periods of abundance. The apple leaf-curling midge [*Dasyneura mali*, Kieff.] was abundant in 1936. Collections of mature larvae on cloth-covered frames placed under selected trees reached maxima on 12th June, 7th August and 1st September. Rainfall, which softened the rolled leaves, influenced the exact time of emergence of the larvae, lack of it delaying the emergence of the second generation by about 10 days. By the use of bands on the trunks of the trees, it was determined that about 10 per cent. of the mature larvae crawl down the tree-trunk, the remainder dropping from the leaves and branches. Bands impregnated with beta-naphthol did not appear to repel the larvae and those caught in them were dead. Of sprays applied during the oviposition period, the most effective appeared to be summer oil.

In field tests on potato, sprays of Bordeaux mixture were applied from 10th July to 24th August, and insecticides were added to the 5 applications from 15th July to 14th August. Treatments were duplicated. Bordeaux mixture is itself an effective repellent for flea-beetles [*Epitrix cucumeris*, Harr.], but the addition of calcium arsenate, rotenone, rotenone with pyrethrum, and nicotine tannate all increased control, in that order. The yield of potatoes, however, followed the inverse order, plots sprayed with nicotine tannate producing 464·4 bushels per acre, and those sprayed with calcium arsenate 420·8 bushels; Bordeaux mixture (5 : 5 : 50) alone produced the fifth largest yield of 439·1 bushels. In field trials against the European corn borer [*Pyrausta nubilalis*, Hb.], sprays were tested in quadruplicate and were applied 4 times at intervals of 5 days, starting with the first appearance of larvae in each field; where maize developed more slowly, a fifth application was given. Ground derris, tank-mix nicotine tannate and thiodiphenylamine gave 95·1, 92·1 and 89·9 per cent. uninfested ears, respectively, while on untreated plants 77·7 per cent. were uninfested. Early harvesting caused the untreated plants to show a better record than the relative infestation warranted.

In further studies on insects concerned in the dispersal of Dutch elm disease [*Ceratostomella ulmi*], the Braconid, *Spathius canadensis*, Ashm., was observed to parasitise a small proportion of larvae of *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh. In experiments on the range of

food-plants of *H. rufipes*, egg-galleries were formed only in American elm [*Ulmus americana*]; numerous holes were dug in the bark of slippery elm [*U. fulva*], some containing an adult; feeding on basswood [*Tilia americana*] was negligible; and red maple [*Acer rubrum* and red cedar [*Juniperus virginiana*] were not attacked. Preliminary studies on the life-history of *Scolytus multistriatus*, Marsh., indicated that possibly there is only one generation a year in Massachusetts.

In experiments in connection with the use of *Cryptolaemus* [*montrouzieri*, Muls.] against mealybugs in greenhouses [*cf.* 24 492], full-grown larvae and pupae did not survive a storage period of 2 months at 45°F., nor 1–3 months of 30–33°F. Temperatures of 60–65°F. retarded the activity of the citrus mealybug [*Pseudococcus citri*, Risso], but development continued at a more normal rate than did that of *Cryptolaemus*. The percentages of the eggs of *Cryptolaemus* that hatched, the average duration of the larval stage and the average number of mealybug eggs eaten by a larva per day were 49·7, 59·4 days and 23·55 at 70°F., and 34·3, 53·5 days and 24·92 at 80°. The adults, on the average, lived for 7·2 days less at 80°. In studies of pyrethrum and derris extracts, as used in commercial sprays, against the red spider [*Tetranychus telarius*, L.], the former were not effective, but the latter, either as rotenone or other extracted resins, gave satisfactory control when applied at concentrations of 2 and 4 per cent., respectively. The emulsified extracts containing 10 per cent. sulphated alcohol as a wetting and spreading agent were diluted to 1 : 200 for application.

The carrot rust fly [*Psila rosae*, F.] on carrots was controlled by seed treatment with mercurous chloride, pure or diluted (1 : 3) with clay; there was no significant difference between the regular grade of mercurous chloride and a specially fine one. In one locality, where field infestation by the second generation amounted to about 11 per cent., effective protection was afforded by 3 applications of naphthalene flakes at the rate of 1 lb. to 100 ft. of row. A single application was useless.

FLANDERS (S. E.). **Habitat Selection by** *Trichogramma*.—*Ann. ent. Soc. Amer.* **30** no. 2 pp. 208–210, 7 refs. Columbus, Ohio, June 1937.

The author considers that *Trichogramma evanescens*, Westw., *T. embryophagum*, Htg., and *T. semblidis*, Aur., are the correct names for the three common North American species usually called *T. minutum*, Riley, *T. pretiosum*, Riley, and *T. evanescens*, Westw., respectively [*cf. R.A.E.*, A **23** 442]; the latter names are those adopted in this and the following abstracts. These egg-parasites are readily reared on many common hosts under artificial conditions, but they are rarely found associated in nature. Available records show that the natural hosts of each are fewer than the suitable hosts, and that these hosts differ in habitat. The fact that each species has a different host complex is due to habitat preference rather than to either physiological or psychological host selection [*cf. R.A.E.*, A **23** 390]. The host records indicate that the dominant species in arboreal, field and marsh habitats, are, respectively, *T. pretiosum*, *T. minutum* and *T. evanescens*. When a species is liberated in a habitat to which it is not adapted, it soon disappears even if suitable hosts are present.

Certain specific characteristics may be accounted for as habitat adaptations. Thus *T. pretiosum* crawls rather than flies when disturbed,

while the opposite is true of *T. minutum*. In the crown of a tree, the parasite can reach its host most successfully by crawling and making very short flights, whilst in field and marsh habitats longer flights are more advantageous. As *T. pretiosum* is more likely to persist in arboreal habitats and tends to be more localised in distribution than is *T. minutum*, parasitism resulting from liberations of it may be more readily measured.

FLANDERS (S. E.). **Notes on the Life History and Anatomy of** *Trichogramma*.—*Ann. ent. Soc. Amer.* **30** no. 2 pp. 304–308, 6 figs., 4 refs. Columbus, Ohio, June 1937.

Trichogramma minutum, Riley, and *T. pretiosum*, Riley [*cf.* preceding abstract] were reared in the eggs of the Arctiid, *Estigmene acraea*, Dru., in California. These eggs each contain enough food to permit the complete development of up to 10 individuals. They were exposed to parasitism for one hour, and at a fairly constant temperature of about 80°F., the life-cycle of both species was completed in 8 days. The incubation period lasted about 22 hours and there were 3 larval instars. The prepupal stage in *T. pretiosum* and *T. minutum* lasted 2 and 2½ days, respectively, and the pupal stage in both species about 3½ days.

Short descriptions are given of the immature stages, and of the alimentary and reproductive systems of *T. pretiosum*.

BARBER (G. W.). **Variations in Populations and in Size of Adults of** *Trichogramma minutum* **Riley emerging from Eggs of** *Heliothis obsoleta* **Fab.**—*Ann. ent. Soc. Amer.* **30** no. 2 pp. 263–268, 1 fig. Columbus, Ohio, June 1937.

An account is given of variations in numbers and size of adults of *Trichogramma minutum*, Riley, emerging from eggs of *Heliothis armigera*, Hb. (*obsoleta*, F.) collected in Virginia and Georgia during periods of high parasitism. The following is substantially the author's summary: Four collections of eggs of *Heliothis* were made. From these collections, adults of *T. minutum* emerged from 2,000 host eggs, and in 1,600 the forewings of the parasites were measured. The population of parasites per host egg ranged from 1 to 5. Approximately twice as many females as males were recovered from each collection. The adult parasites were quite variable in wing length. The largest male had about 25 times the bulk of the smallest male, and the largest female had about 40 times the bulk of the smallest female. Whilst the wing lengths of several parasites emerging from a single host egg were quite frequently identical, they were more often different. In each locality and in each sex, the mean wing length of parasites regularly decreased as the population per host egg increased. It thus appears that a determining cause of variation in size of adults of *T. minutum* reared in a single host egg is the competition for food among the larvae.

BUSSART (J. E.). **The Bionomics of** *Chaetophleps setosa* **Coquillett (Diptera : Tachinidae).**—*Ann. ent. Soc. Amer.* **30** no. 2 pp. 285–295, 2 pls., 10 refs. Columbus, Ohio, June 1937.

The investigations described were carried out in Illinois on the bionomics of *Chaetophleps setosa*, Coq., which is a parasite of the adults

of *Diabrotica melanocephala*, F. (*vittata*, F.) on cucurbits and appears to be widely distributed in the northern United States. All available evidence suggests that this Tachinid is exclusively viviparous [*cf. R.A.E.*, A **14** 353]; the female inserts a newly hatched larva into the beetle when it is in flight, and the raised elytra leave the vulnerable dorsal surface of the abdomen exposed. Usually there is only a single larva in each host, although as many as 7 have been found. In such cases, they are generally in various stages of development, suggesting the occurrence of multiple parasitism. Very small adults are sometimes found, indicating that occasionally two larvae may complete their development in the same host. A key to the three larval instars is given. The first lasts 2–3 days after the larva has been inserted, and the second and third 8–12 days each. The larva feeds and develops in the interior of the host, and when mature breaks its way out at the junction of the head and thorax, leaving the beetle disrupted. In some cases, however, the larva does not emerge completely, but forms its puparium partly within the abdominal cavity of the host. If, as often happens, the host dies before the larva is ready to emerge, the latter also dies unless it is old enough to be able to emerge within 24–30 hours. Pupation generally takes place near the host under leaves or clods of earth or on the exposed surface of the soil. The pupal stage lasts 5–7 days in the summer and 10–20 in the autumn. The winter is passed in the second larval instar. There are 5 generations annually, the adults appearing about 3rd July, 6th August, 10th September, 15th October and 5th June, but they overlap considerably, as there is a long larviposition period.

The average percentage parasitism of *D. melanocephala* from 1932 to 1934 was 18·71. The highest percentage, 58·6, occurred in June 1933, in beetles collected on cucumbers in an open greenhouse. Of 3,932 and 2,950 male and female beetles dissected, 19·98 and 17·05 per cent., respectively, were parasitised. The females probably escape attack by spending relatively more time in the ground, where they lay their eggs. There are three peaks of parasitism, from 25th June to 25th July when the overwintered beetles are attacked by flies of two generations, and in the periods soon after 15th August and 25th September, where new beetles of the first and second generations, respectively, are available in numbers.

In the summers of 1933 and 1934, 5·41 per cent. of 499 individuals of *Diabrotica duodecimpunctata*, F., collected on cucumbers were parasitised by *C. setosa*, the percentages of males and females attacked being 6·13 and 4·62, respectively. This is the first record of parasitism of this species by *C. setosa*. Beetles collected in maize fields were not parasitised.

WALKDEN (H. H.). **Noctuidae taken at a Bait Trap in Kansas.**—*Ann. ent. Soc. Amer.* **30** no. 2 pp. 296–303. Columbus, Ohio, June 1937.

In connection with cutworm investigations in Kansas, a bait trap was operated on 2,615 nights from 1921 to 1931 inclusive, and data are given in this paper on the seasonal flight, proportion of sexes, and numbers of the different species of the large Noctuids caught during this period. No account is given of the smaller species or those belonging to the genus *Catocala*. The trap was of the ordinary cylindrical fly-trap type, 30 ins. high and 18 in diameter with an internal

cone opening at the top. The legs projected about 4 ins. below the cone, and the bait, consisting of crushed bananas and a 10 per cent. solution of molasses in water, was placed in a shallow saucer on the ground between them. The trap was usually baited as soon as the temperature rose in the spring.

Altogether, 72 species were taken during the period, the smallest number in a year being 16 in 1930, and the largest 43 in 1928. The only species caught in each year were *Agrotis ypsilon*, Hfn., *Heliothis armigera*, Hb. (*obsoleta*, F.), *Cirphis unipuncta*, Haw., *Lycophotia margaritosa saucia*, Hb., and *Prodenia ornithogalli*, Gn. The last four, together with *Laphygma frugiperda*, S. & A., and *Chorizagrotis* (*Euxoa*) *auxiliaris*, Grote, caused widespread injury at certain times during the period. A table shows the yearly catch of the different species, but, as the bait was not equally attractive to all, the numbers do not indicate accurately their relative abundance.

In some years, the Noctuids were on the wing as early as 2nd March and as late as 17th November; the first species to be taken were *Agrotis ypsilon*, *Cirphis unipuncta* and *L. m. saucia*, and these were also the last in the autumn.

Two principal flights could be distinguished, the first from late April to early June, and the second from late August to late October. There was little activity during the hot summer period. The flight period of species having one generation annually occurred as a rule during September and October, but the adults of *C. auxiliaris* appeared in late May and early June, and again in October, after an apparent aestivation period of nearly four months.

Of the 14,741 moths recorded during the 11-year period, the sex was determined for 9,810, belonging to 27 species, and 36 per cent. were females. In only 9 species did the percentage of females equal or exceed that of the males, and 8 of these had more than one generation annually. The bait trap appears less attractive to females of single-brooded species than to males, as in breeding experiments with various species the proportion of the sexes is nearly equal.

Knowlton (G. F.) & Allen (M. W.). **Bramble Fruit Aphids.**—*Ann. ent. Soc. Amer.* **30** no. 2 pp. 309–316, 3 pls. Colombus, Ohio, June 1937.

Records are given of 9 Aphids infesting raspberry and other bramble fruits in Utah, Idaho and Washington, three of which are described as new, *viz.*, *Amphorophora arnicae thatcheri*, subsp. n., on loganberry in Idaho, and *A. bonnevilla*, sp. n., and *A. rubicumberlandi*, sp. n., on raspberries in Utah and Washington, respectively. Two British species, *Macrosiphum rubiellum*, Theo., and *M. rubifolium*, Theo., are re-described.

Back (E. A.) & Cotton (R. T.). **Control of Insect Pests in stored Grain.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1483 (revd.) 36 pp., 41 figs. Washington, D.C. December 1936. [Recd. August 1937.]

In this revision of a bulletin already noticed [*R.A.E.*, A **14** 470; **18** 347], chloropicrin is recommended for the fumigation of grain in terminal and country elevators. It is applied directly to the grain stream by means of a special apparatus consisting of a container from

the base of which a tube with a valve runs to the grain stream near the point where it enters the bin. A dosage of 2 lb. (3 lb. for oats) per 1,000 bushels grain, with 3 lb. for the first and last 1,000 bushels, gives satisfactory results. Before the flow of grain is started, 2–4 lb. chloropicrin should be run into the empty bin. The treatment has a deleterious effect on the baking and milling qualities of the grain, but this passes off if it is well aerated. Germination is reduced. A mixture of ethylene oxide and carbon dioxide gives complete control of grain insects, even at winter temperatures; it is non-inflammable and safe for the operator and does not affect the baking and milling qualities of the grain. A mixture of 3 lb. liquid ethylene oxide with 30 lb. solid carbon dioxide is introduced for every 1,000 bushels grain as it enters the bin so that the fumigant is thoroughly distributed throughout the grain [*cf.* **18** 647]. In order to counteract leakage, the dosage for the first 1,000 and the last 500 bushels should be made proportionally greater; that for the rest of the grain should then be reduced, so that the average of 33 lb. per 1,000 bushels is preserved.

Salt (R. W.). **Studies on the Freezing Process in Insects.**—*Tech. Bull. Minn. agric. Exp. Sta.* no. 116, 41 pp., 3 figs., 40 refs. St. Paul, Minn., August 1936. [Recd. August 1937.]

The following is taken from the author's summary: The natural and artificial control of insects by low temperatures is of great importance. Its practical application is hampered by a lack of knowledge concerning the fundamental problems involved and of precise methods of study. The literature is reviewed in detail, and improved apparatus for studying the undercooling and rebound points is described.

Insects exhibit a considerable variation in the effect that desiccation or other change in water content has on their undercooling points. Puparia of *Musca domestica*, L., lost 4 per cent. of their weight when exposed to warm, dry laboratory conditions for several hours, while their undercooling points dropped from −12 to −22°C. Adults of *Leptocoris trivittatus*, Say, desiccated over calcium chloride at 2 and 20°C., lost over 20 per cent. of their weight while the undercooling points remained stationary. Larvae of *Ephestia kuehniella*, Zell., had almost the same percentage water content whether they were last-instar feeding larvae, early prepupal larvae, or prepupal larvae from cocoons, yet the undercooling points averaged −5·8, −8·0 and −21·3°C., respectively. Hibernating bugs (*Chlorochroa sayi*, Stål) increased in water content from 53 to 67 per cent. of total weight when fed for 5 days, but their undercooling points remained unchanged.

Moisture in contact with the body surface, usually in the form of ice, reduces and sometimes completely eliminates undercooling in many insects, while others are not affected by even a heavy coating of water or ice. The factors governing the action of contact moisture appear to include the extent and "quality" of the contact and the type of integument of the insect. Soft-bodied insects such as Dipterous and Lepidopterous larvae are usually susceptible, although the heavily sclerotised wasps of the genus *Polistes* are also very susceptible to ice crystal inoculation. Larvae of *Lucilia sericata*, Mg., *Musca domestica*, *E. kuehniella*, *Plodia interpunctella*, Hb., and *Lachnosterna* (*Phyllophaga*) are all readily inoculated by contact moisture. The pupae are slightly harder to inoculate, exhibiting an apparent individual variation,

which probably depends more on the quality of the contact than on the insect. Eggs seem to be very resistant or even proof against inoculation.

The undercooling points of adults of *Attagenus piceus*, Ol., were recorded correctly whether the thermojunction was placed under or on the elytra. The observed rebound points were higher when recorded from beneath the elytra, but the true rebound points were higher still.

Pupae of *Sitotroga cerealella*, Ol., exhibited a correlation of 0·965 between water content in mg. and the size of the rebound. The observed rebound points were many degrees lower than the true freezing point, but the latter was more closely approached as the water content of the pupae increased. Thus the relationship was merely physical and indicated only a very uniform technique. That other stages of the same or different species did not react similarly is due to a more homogeneous liquid composition during the pupal period.

The rebound points as observed were proved, by several different methods, to be incorrect. Larvae of *Lucilia sericata* inoculated by contact moisture were found to be frozen hard at −2°C. The melting point range of larvae of *Ephestia kuehniella*, determined by observing the change from physical "hardness" to "softness" was found to lie above −1·9°C. When the larvae were pierced by the thermocouple, the rebound points lay between −1·25 and −1·4°C. if the amount of undercooling was not too great. Larvae inoculated by contact moisture were frozen at similar temperatures. Thus these larvae, the observed normal rebound points of which averaged −12·5°C., had a melting point range near −1, a freezing point (by inoculation) of −1·5 to −2·0, and a rebound point (by piercing) of −1 to −1·5°C. The technique has not yet been perfected sufficiently to bring these slightly different figures together, but they would undoubtedly check closely with more refined methods. It was proved that physical hardness was due to freezing of the body fluids and not to congealing of the fats.

Oak borer [Coleopterous] larvae with undercooling points of approximately −40°C. also had high freezing points (above −5°C.) but very little freezing took place at these high temperatures. The insects did not become very hard until the temperature dropped a few degrees further.

Three species of stored-product pests, *E. kuehniella*, *S. cerealella* and *A. piceus*, were tested for the location of their minimum lethal temperatures. The variation of these temperatures is given in the form of maximum, minimum, and mean lethal low temperatures. A temperature of −27·0°C. kills all stages of *Ephestia*, and −27·5°C. all stages of *Sitotroga*. The most resistant stage in each case is the newly hatched unfed larva. The first feeding of these larvae lessens their cold-resistance so effectively that they are then the least resistant stage. There seems to be evidence that this is a rather general phenomenon in insects, at least of certain types. *Malacosoma disstria*, Hb., behaves similarly. The food ingested by the newly hatched larvae of this species as they chew their way out of the egg-shell raises their undercooling points more than 20 degrees Centigrade.

The quantity factor of cold, effective on many insects infesting stored products, was tested to determine whether it could act in a short enough time to affect experiments designed for the study of the intensity factor alone. For adults of *Tribolium confusum*, Duv., at temperatures of −15°C. the quantity factor became lethal in 10–15 minutes. From a study of the mortality curves, it is obvious that at

lower temperatures and shorter exposures the two factors become hopelessly intermingled, so that it seems probable that death results from the interaction of both.

A comparison was made of mortality data obtained by two different methods. Adults of *T. confusum* were exposed to low temperatures individually and *en masse*. In the former case only 20 per cent. froze normally, the other 80 per cent. being inoculated by a liquid secreted by the insects themselves. Each set gave a typical S-shaped mortality curve. The insects exposed *en masse* gave results intermediate to those from the two sets of individuals.

In the case of insects that can withstand freezing, the minimum lethal temperature is lower than the undercooling point and may be very simply determined by test exposures. For insects that are killed by freezing, the undercooling point is the all-important minimum lethal temperature. If the insect is dry or immune to inoculation by contact moisture, then it is the normal undercooling point that is important. If the insect is inoculated by contact moisture, undercooling is limited, and a new and higher undercooling point is observed. The location of this new point is dependent on many factors, and it may even coincide with the freezing point; in any case it becomes the minimum lethal temperature.

Schedl (K. E.). **Quantitative Freilandstudien an Blattwespen der *Pinus banksiana* mit besonderer Berücksichtigung der Methodik.** [Quantitative Field Studies on Sawflies of *Pinus banksiana* with special Reference to the Methods used.]—*Z. angew. Ent.* **24** pts. 1–2 pp. 25–70, 180–215, 32 figs. Berlin, April & July 1937.

In the summer of 1929, Jack pine [*Pinus banksiana*] in Quebec and Ontario was severely attacked by sawflies, of which the adults from cocoons collected in the winter of 1929–30 were identified as species, probably new, of *Diprion* (*Neodiprion*) [*R.A.E.*, A **19** 577, 756]. The author, who was in charge of a station in north-western Ontario, describes the climate, topography and other features of this region and records the results of population studies on these sawflies made in 1930–31. A detailed description is given of the technique used. Samples were taken at very short intervals, as the aim was to follow by their means the whole course of development from egg to prepupa.

As regards the identity of the sawflies, the author states that in 1930 he found that there were three species. His material was sent for description to W. Middleton, who, however, described only one of the species, as *D.* (*N.*) *swainei* [**21** 81]. The author himself, therefore, described the other two in 1935 as *D.* (*N.*) *nanulus* and *D.* (*N.*) *dubiosus* [*Mitt. dtsch. ent. Ges.* **6** pp. 39–44].* Keys are given to both sexes of these sawflies and *D. abietis*, Harr.; the males of *D. swainei* and *D. dubiosus* cannot be distinguished. A key to the larvae of *D. swainei*, *D. nanulus* and *D. dubiosus* is also given.

For these three species, detailed accounts are given of adult emergence, pairing, duration of adult stage and oviposition. Eggs

* In making these statements, the author was apparently unaware of another paper by Middleton [**21** 349–350], in which the latter described females of four new species of *Diprion* (*Neodiprion*), *viz.*, *rugifrons*, *nigroscutum*, *ferrugineum* and *ontarioensis*, recording all of them as having been reared from *Pinus banksiana* by Schedl in Ontario. *D. swainei*, on the other hand, was described from *P. banksiana* in Quebec from material collected and reared by M. Dunn.—Ed.

laid by unfertilised females did not hatch, and attempts to cross *D. swainei* and *D. dubiosus* were unsuccessful. *D. swainei* nearly always laid all its eggs in the needles of one twig ; *D. dubiosus* did so in many cases ; *D. nanulus* usually oviposited in needles of several twigs. The first two oviposited from late May to mid-July, the peak for *D. swainei* being a week later than for *D. dubiosus*, and the last from August to the beginning of September, hibernating in the egg stage, whereas the first two do so as prepupae. The egg stage of *D. swainei* lasted 24·4–28·3 days at temperatures of 59·2–65·4°F., and that of *D. dubiosus* 25·8–31·2 days at 59·4–62·5°F.

Observations on hatching and larval behaviour in all these species are recorded at length. As a rule the larvae were gregarious in all instars. The average duration of larval development was 28 days in 1930 and 32 in 1931 for *D. nanulus*, 55 in 1930 and 25 in 1931 for *D. dubiosus* and 52 in 1931 and probably less in 1930 for *D. swainei*. The quantity of needle-material consumed by the larvae is estimated in terms of average needles, which are 25 mm. long in this region. It was found that despite the difference in duration of larval stage, the average number of needles eaten was very similar for the three species, being 37·49 for *D. nanulus*, 33·8 for *D. dubiosus*, and 39·6 for *D. swainei*. Based on a consumption of 40 such needles by a larva of *D. swainei* and the determination of the numbers of normal needles on a characteristic Jack pine (27 years old, 48 ft. high, 6 ins. in diameter at breast height) as about 341,000, it is calculated that 3·5 cocoons per sq. ft. of ground at the beginning of the season would lead to complete defoliation.

A detailed account is given of observations made on full-fed larvae of *D. swainei*. Most of them are able to undergo their last free moult in the ground litter. Larvae that went through this free moult (thus entering the prepupal stage, in which their slow movements render them defenceless) on the tree were found to descend within 24 hours to spin their cocoons. On 30th September 1931, 836 individuals were on the ground and 325 were on the tree ; and 51 per cent. of the former but only 4·8 per cent. of the latter were prepupae. The percentage of parasitism was very much higher in the individuals on the tree.

Hofmann (C.). **Die Bekämpfung der Weisstannenlaus** *Dreyfusia nüsslini* **C. B.** (= *nordmannianae* **Eckst.).** [The Control of the Silver Fir Aphid, *Chermes nordmannianae*.]—*Z. angew. Ent.* **24** pt. 2 pp. 161–180, 5 figs., 23 refs. Berlin, July 1937.

In Germany, *Chermes* (*Dreyfusia*) *nordmannianae*, Eckstein (*nüsslini*, Börner) is increasing in importance as a pest of silver fir (*Abies*), especially of trees from 10 to 30 years old. Its development, as studied in 1935–36 in the Pfälzer Wald and Frankenwald districts, South Germany, was very similar to that observed in Switzerland [*R.A.E.*, A **17** 639].

The first full-grown sistentes were seen in April and soon began oviposition, which extended into May. In May, most of the young larvae of the new generation hatched. They were either of the sistens type (called neosistentes while in the first of their four stages of development) or of the progrediens type (neoprogredientes). Some of the neosistentes remained on the bark and the shoots without developing further until late autumn ; others developed (in late July

and early August) into mature sistentes that laid eggs. Further neosistentes hatched from these eggs and joined those already present. At the end of October, the majority of the neosistentes moulted to the second instar and began to hibernate. In the following February, they resumed their development, becoming mature sistentes in April.

The neoprogredientes completed their development in June. Some became mature progredientes and oviposited on the underside of the needles on which they had lived. From their eggs hatched neosistentes that attached themselves to the bark of the shoots. The other neoprogedientes developed into winged sexuparae destined to fly to *Picea orientalis*, which tree, however, does not occur in these forests.

The neosistens stage existed throughout most of the year and was the only form present in the earlier part of July and again in September–October. It is an essential stage in the maintenance of infestation on *Abies*, and, as it is almost free from waxy secretions, it should be easier to kill by insecticides than are other stages. Being fixed on the underside of the juncture of the new growth, however, it is less readily observed than other stages, against which chemical control has hitherto been mainly directed.

In 1936, the author carried out experiments with a tar distillate spray and a nicotine dust (both of which had previously been found satisfactory against *C. nordmannianae* and with the dinitro compound, "Detal" [**25** 525]. The first two gave mortalities of 70–95 per cent. in field tests. In laboratory tests, all the neosistentes died in half an hour after dusting with "Detal" at the rate of about 44 lb. per acre at a temperature of 20–22°C. [68–71·6°F.] and 60 per cent. humidity. Field tests, summarised in a table, gave mortalities of 60–100 per cent. in July and 85–100 per cent. in September. In July, though not in September, several instances of scorching of the needles occurred, apparently only when the firs were exposed to strong sunshine after dusting. Compared with the nicotine dust, "Detal" acted more rapidly, covered twice the area for a given quantity owing to its fine state of division, and was much cheaper.

PRELL (H.). **Die Gefährdung von Seidenraupen durch Arsenvergiftung.** [The Danger to Silkworms of arsenical Poisoning.]—*Z. angew. Ent.* **24** pt. 2 pp. 248–267. Berlin, July 1937.

Data from the literature on the effect of arsenicals on the larvae of *Bombyx mori*, L., are discussed. It is calculated that the minimum lethal dose for a full-grown lava was about 3 and 6–8 mmg. As in the case of arsenites and arsenates, respectively. Mortality among silkworms in an experimental silkworm farm at Tharandt, Germany, has been traced to arsenical poisoning, apparently caused by feeding on mulberry leaves contaminated with arsenic from airborne furnace gases. The author refers to a parallel case with larvae of *Dasychira pudibunda*, L. [*R.A.E.*, A **25** 385].

HÖLLDOBLER (K.). **Ueber die wirtschaftliche Bedeutung der roten Knotenameise, *Myrmica rubra laevinodis* Nyl.** [On the economic Importance of *M. rubra laevinodis*.]—*Z. angew. Ent.* **24** pt. 2 pp. 268–276, 2 figs., 8 refs. Berlin, July 1937.

This is a record of observations on the food habits of *Myrmica rubra laevinodis*, Nyl., which is a common ant in Germany. It was not

associated with root Aphids and did not tend leaf Aphids to any great extent. Vegetable food was almost as important for it as animal food, such as soft-skinned insects, and far more so than the trophobiosis with Aphids. It was often found in fallen fruit and hollowing out the fruit of strawberry.

Sellke (K.). **Beobachtungen über die Bekämpfung von Wiesenschnakenlarven (*Tipula paludosa* Meig. und *Tipula czizeki* de J.).** [Observations on the Control of Larvae of the Tipulids, *T. paludosa* and *T. czizeki*.]—*Z. angew. Ent.* **24** pt. 2 pp. 277–284, 4 refs. Berlin, July 1937.

Various measures against Tipulid larvae are based on the assumption that they come to the surface of the ground by night. At Burg, in the Spreewald district, near Berlin, however, a poison bait that had proved effective in other instances failed to control a heavy infestation by *Tipula paludosa*, Mg. (40 per cent.), *T. czizeki*, de Jong (56 per cent.), *T. nigra*, L., *T. vernalis*, Mg., and *Nephrotoma* (*Pachyrhina*) *lunulicornis*, Schum. *T. czizeki*, previously recorded from only three localities in Germany, differs from *T. paludosa*, in egg development, genital characters and flight-period [*R.A.E.*, A **25** 489]. Owing to this failure the author carried out and here describes in detail experiments in the field at Burg and in the laboratory on the movements of the larvae of these two species.

It appeared that the larvae rose to the surface of the soil principally in search of food. Darkness, moist soil and humidity of the air at ground level favoured but did not ensure their rising, and strong light and dry air checked but did not prevent it. In meadowland, the depth at which the larvae live and the digging movements they make in search of food depend on the position and number of the plant roots. Tipulids deposit their eggs just beneath the surface of the ground, and it was found that the first-instar larvae remain immediately below the turf, where they could probably be killed by means of a contact insecticide or a chemical manure. In preliminary experiments the author used a special grade of finely ground kainit. Applications at the rate of about 887 and 1,330 lb. per acre were made on 24th September 1935 against the young larvae of *T. paludosa* and produced a mortality of 47 per cent., judged from examinations on 25th May 1936. Similar applications on plots containing eggs of *T. czizeki* were made on 1st November 1935, but the larvae of this species were too scarce in May 1936 for the effect of the treatment to be ascertained.

Stammer (H.-J.). **Eine Riesenkolonie der roten Waldameise (*Formica rufa* L.).** [A Giant Colony of the Red Forest Ant, *F. rufa*.]—*Z. angew. Ent.* **24** pt. 2 pp. 285–290, 1 map, 7 refs. Berlin, July 1937.

In view of the value of *Formica rufa*, L., in destroying pests in German forests [*cf. R.A.E.*, A **24** 8, etc.], a description is given of a colony of this ant in Mecklenburg, comprising 58 main and 31 branch nests and covering about 15 acres, with a network of ant roads totalling about 4½ miles.

Trägårdh (I.) & Butovitsch (V.). **Einige Bemerkungen über quantitative Untersuchungsmethoden zur Berechnung des Borkenkäferbefalls.** [Some Remarks on quantitative Investigation Methods for calculating Bark-beetle Infestation.]—*Z. angew. Ent.* **24** pt. 2 pp. 291–306. Berlin, July 1937.

The authors do not accept certain criticisms of their report on measures against bark-beetles in Sweden [*R.A.E.*, A **23** 222] advanced by Schedl in a recent paper [**24** 814], and they discuss his objections, observing that he considered their work to be a paper on the science of population, whereas it is predominantly a report on control measures.

Goidànich (G.). **Das Ulmensterben in Italien.** [The Death of Elms in Italy.]—*Z. PflKrankh.* **47** no. 8 pp. 417–425, 9 figs. Stuttgart, 1937.

An account is given of Dutch elm disease, caused by *Ceratostomella ulmi*; it is very injurious in Italy, where elms are largely grown as supports for grape-vines. Its spread is attributed mainly to Scolytids, including *Scolytus sulcifrons*, Rey, *S. multistriatus*, Marsh., and *Hylesinus* (*Pteleobius*) *vittatus*, F., of which *S. sulcifrons* is the most important [*R.A.E.*, A **22** 606]. The author considers that the correct generic name for the fungus is *Ophiostoma*.

Nitsche (G.) & Mayer (K.). **Zur Bekämpfung der Rübenblattwanze** (*Piesma quadratum* **Fieb.**) **V.** [Concerning the Control of the Beet Leaf Bug, *P. quadratum*. V.]—*Z. PflKrankh.* **47** no. 8 pp. 453–461, 3 maps, 1 graph, 12 refs. Stuttgart, 1937.

This report is one of a series on *Piesma quadratum*, Fieb., attacking beet in Germany [*cf. R.A.E.*, A **24** 290; **25** 581, etc.] and deals with work against it in 1936. The trap-strip method proved effective, but in heavy soil the ploughing under of trap-strips is difficult and liable to destroy the soil dressing. Observation of the migration of the bugs from their winter quarters showed that the strips need not be on the actual beet fields, but might be planted nearby, especially on light soils or on fields planted with beet the preceding year. Such strips averaged 7 per cent. of the total area under beet. In experiments not yet concluded, some chemicals have given satisfactory results in destroying both plants and bugs on trap-strips, thus rendering ploughing under unnecessary, but none has been proved suitable for checking the bugs on actual beet fields.

Andersen (K. T.). **Die Blattrandkäfer** *Sitona griseus* **F. and** *Sitona gressorius* **F. als Lupinenschädlinge.** [*S. griseus* and *S. gressorius* as Pests of Lupins.]—*Anz. Schädlingsk.* **13** no. 7 pp. 81–84, 5 figs., 10 refs. Berlin, 15th July 1937.

In 1933, *Sitona grisea*, F., did considerable injury to the leaves of lupins in Brandenburg in association with a larger species, *S. gressoria*, F., previously known only from southern Europe and Palestine. The characters differentiating the two species are given. The biology of the adults and larvae resembles that of *S. lineata*, L. [*R.A.E.*, A **19** 588] except that they feed on lupins. *Lupinus albus* is apparently

preferred to *L. angustifolius* and *L. luteus*. In Germany, the overwintered adults appear early in May and oviposit in May and early June on the leaves or ground. The egg stage of both species lasted about a week at about 27°C. [80·6°F.]. The dependence of egg development on temperature is best represented by a catenary curve, though this is less accurate for *S. gressoria* than for *S. grisea* and *S. lineata*, *S. gressoria* requiring 31 days for incubation at 10°C. [50°F.] and *S. lineata* 40 days. The duration of the larval and pupal stages of *S. gressoria* was not ascertained, but the author found young adults in autumn. These oviposited in captivity until the temperature fell to about 10°C., and some of the eggs survived the winter. The adults of *S. gressoria* throve best at 23·5°C. [74·3°F.], and those of *S. lineata* at 25°C. [77°F.]. Numbness of *S. gressoria* through cold occurred at 0·5°C. [32·9°F.] and death through heat at 44°C. [111·2°F.].

Amsel (H. G.). **Bemerkungen über den Samenzünsler** *Paralispa gularis* **Z.** [Notes on the Pyralid, *Aphomia gularis*.]—*Anz. Schädlingsk.* **13** no. 7 pp. 85–87, 3 figs., 30 refs. Berlin, 15th July 1937.

In view of recent records of *Aphomia* (*Paralipsa*) *gularis*, Zell., in warehouses in Germany [*R.A.E.*, A **24** 345, etc.], notes are given on the classification and adult morphology of this Pyralid, together with a bibliography regarding it. The author considers that the genus *Paralipsa*, of which *gularis* is the type, is distinct from *Aphomia* and should be spelt *Paralispa*.

Roesler (R.). *Phytomyza rufipes* **Mg. (Dipt.) als Blumenkohlschädling.** [*P. rufipes* as a Pest of Cauliflowers.]—*Anz. Schädlingsk.* **13** no. 7 pp. 87–88, 2 figs. Berlin, 15th July 1937.

In the summer of 1936, the larvae of *Phytomyza rufipes*, Mg., caused yellowing of the heart leaves of cauliflowers in seedling beds in Zittau, Germany, by mining the leaves and stems. In mature cauliflowers, the injury occurred in the leaf stalks, but did not extend to the stems. Some beds were kept free from attack by fortnightly applications of a spray of nicotine and soap.

Trappmann (W.). **Methoden zur Prüfung von Pflanzen- und Vorratsschutzmitteln. X–XXXIII.** [Methods for testing Materials used in the Protection of Plants and Stored Products. X–XXXIII.] —*Mitt. biol. Reichsanst.* Heft 55, 270 pp., illus., many refs. Berlin, July 1937.

The great increase in the number of insecticides and fungicides placed on the market since 1920 has led official German research organisations to undertake their examination and certification. The Imperial German Biological Institute has already published papers on such work done by it and other institutions and some of these have been noticed [*R.A.E.*, A **23** 523, etc.]; of others by various authors here compiled by W. Trappmann, those dealing with insecticides are noticed below, their numbers and pages being shown in brackets.

Trappmann (x, pp. 5–11) outlines the conditions subject to which a preparation is examined and approved. A. Winkelmann (xv, pp. 31–37) describes the laboratory and field tests to be used for materials against pests and diseases of grape-vines. Trappmann and W. Tomaszewski (xx, pp. 81–142) give a very detailed account of the

methods to be used in the physical and biological examination of different insecticides intended for various classes of insect. H. Maercks (xxi, pp. 143–150) describes a technique for laboratory tests of contact insecticides for destroying the eggs and larvae of the vine moths, *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff. Trappmann (xxv, pp. 171–174) and J. Liese (xxvi, pp. 175–178) deal with the procedure required for laboratory and house tests of materials supplied to destroy *Hylotrupes bajulus*, L., in timber and to prevent infestation. G. Kunike (xxviii, pp. 185–189) indicates the methods required for testing liquid sprays, mist sprays and fumigants for empty grain warehouses and dusts and fumigants for stored grain, all against *Calandra granaria*, L., and also (xxix, p. 191) the conditions to be fulfilled in tests of fumigation plants for grain silos. A. Hase (xxx, pp. 193–203) describes the biological tests of substances intended to render woollen materials proof against infestation by wool pests, and K. Gösswald (xxxi, pp. 205–208) describes the correct procedure for breeding the clothes moth, *Tineola biselliella*, Humm., permanently on a large scale for the purpose of such biological tests. K. Gösswald deals with laboratory and field tests of stomach poisons (xxxii, pp. 209–243) and dust contact insecticides (xxxiii, pp. 245–270) against ants.

Speyer (W.). **Entomologie.**—*Wiss. ForschBer.* Naturw. Reihe **43** Demy 8vo, 194 pp., 17 pp. refs. Dresden & Leipzig, T. Steinkopff, 1937. Price paper *M.*13, linen *M.*14·50.

This volume belongs to a series in which are reviewed in a condensed form important papers published since 1914 in the various branches of natural science. Many subjects, such as genetics, psychology, etc., that touch upon entomology, are ignored or briefly dealt with, but much attention is devoted to the biology, ecology and variation in abundance of insects, with chapters also on parasitism, migration and economic importance. The volume is intended for the student and the non-entomologist with a biological training.

Klinkowski (M.) & Lehmann (H.). **Kranke Luzerne.** [Diseased Lucerne.]—Demy 8vo, 132 pp., 16 figs. Neudamm, J. Neumann, 1937. Price *M.* 4·50.

The acreage under lucerne has roughly doubled in Germany since 1913 and was about a million acres in 1936, so that the importance of the fungi and insects injurious to it has increased. The introductory section of this volume is a key by both authors to the diseases and pests of lucerne arranged according to symptoms and parts of the plant injured and indicating the page on which the causal agent is dealt with in the text. The part of the main section devoted to animal pests is by Lehmann, and it includes brief accounts of the bionomics and control of a large number of insects.

Malenotti (E.). **Appunti sul " verme " del pesco** (*Cydia molesta*, **Busck) nel 1936.** [Notes on the Peach Moth, *C. molesta*.]—*Italia agric.* **74** no. 4, repr. 14 pp., 11 figs. Rome, April 1937.

Bait-trap records showed that 5 generations of *Cydia molesta*, Busck, occurred on peaches in Venetia in 1936 [*cf. R.A.E.*, A **24** 514]. The third generation was more than twice as numerous as either the fourth

or fifth and more than three times as numerous as it had been in 1935. A shrivelling of the fruits of some varieties of pears growing near peach orchards was caused by the larvae feeding within the fruiting spurs, on which they pupated.

Experiments were continued on a larger scale with bands of corrugated paper dipped in beta-naphthol and oil [*cf. loc. cit.*]. They were applied to the larger branches of peach trees and caught and killed averages of 8–20 larvae per tree, but are not thought likely to be of much value in control. Tests were also made with a spray of nicotine tannate, prepared by dissolving 135 gm. tannic acid in 33 litres water and then adding 35 cc. concentrated nicotine. Of this spray, 27 litres [about 6 gals.] were used to make 6 applications on four 10-year-old peach trees. The leaves and fruits were not scorched, and 31·7 per cent. of the fruits were free from injury by *C. molesta*, as compared with 16·5 per cent. on untreated trees. The rest of the spray was applied to pears against *Psylla pyricola*, Först., and gave good control.

Cameron (A. E.). **Insect and other Pests of 1936.**—*Trans. Highl. agric. Soc. Scot.* 1937 repr. 47 pp., 21 figs., 23 refs. Edinburgh 1937.

An account is given of the bionomics of the heather beetle, *Lochmaea suturalis*, Thoms., in Scotland and the problem of its control [*cf. R.A.E.*, A **24** 362, 641]. Experiments were carried out to test the resistance of the beetles to low temperatures. Adults that had been hibernating for at least 2 months were collected under sphagnum on 23rd December 1936, when the ground temperature was 32°F. Exposure for 24 hours at 10°F. or 3 hours at 6°F. was lethal, but they survived for 24 hours at 14°F. Temperatures between 10 and 19°F. were, as a rule, only fatal after prolonged exposures, but beetles kept at 60°F. for several days before the experiment did not survive an exposure of 24 hours at 19°F. It is thought that, in the field, the beetles can probably withstand the fluctuations of temperature even in hard winters, but that, after emerging from hibernation, they may be less resistant to unseasonable spring frosts. This species and the heather weevil, *Strophosomus lateralis*, Payk., were both able to survive indefinite exposures to 32°F. The adults of the latter species also hibernate in the soil.

Notes are given from the literature [*cf.* **14** 612] on the bionomics and control of *Lyonetia clerkella*, L. which was recorded in August 1936, for the first time in Scotland, on apple trees in Fife. In the same orchard, apple leaves were seriously disfigured by the larvae of another Tineid.

Observations on *Chermes* (*Adelges*) *cooleyi*, Gill., on Douglas fir [*Pseudotsuga taxifolia*] and Sitka spruce [*Picea sitchensis*] are reviewed [*cf.* **24** 791 ; **25** 282].

Manolache (C.), Dobreanu (E.) & Dimitriu (F.). **Contribuţiuni la biologia insectei** *Cassida nebulosa* **L. in România.**—*Anal. Inst. Cerc. agron. Român.* **8** pp. 477–500, 1 pl., 14 figs., 6 diagr., 57 refs. Bucharest, 1936. (With a Summary in French.) [Recd. August 1937.]

In recent years *Cassida nebulosa*, L., has been very abundant on chenopodiaceous plants in neglected fields in Rumania. An investigation on its bionomics was carried out in 1931–36 in view of the risk of

its becoming a pest of beet [*cf. R.A.E.*, A **24** 75, etc.]. There are two generations a year. The adults hibernate under dead leaves in forests or under plants remaining in the fields. They become active in late April or early May and pair some days afterwards. The eggs are laid in clumps on both sides of the leaves of *Chenopodium* and *Atriplex*, and, more rarely, on beet. The oviposition period may last about two months; the greatest number of eggs laid by one female, kept at 30°C. [86°F.], was 1,046, with a maximum of 30 on one day. The adults of the first generation appear about the end of June or the beginning of July. Under field conditions, and at controlled temperatures of 22·2°C. [71·96°F.], and 30°C. [86°F.], the egg stage lasted 10–12, 6·6 and 4·2 days, the larval stage 21·22, 14 and 8·4 days, and the pupal stage 12–14, 6 and 3 days, respectively. The preoviposition period lasted for 16–17 and 5–8 days at temperatures of 22 and 30°C. The eggs were parasitised by three species of Chalcidoids, including *Trichogramma evanescens*, Westw., the larvae by *Tetrastichus rhosaces*, Wlk., and *T. cassidarum*, Ratz., and the pupae by *Brachymeria* (*Chalcis*) *punctulata*, Först., and *T. rhosaces*. Methods of control consist in destroying *Chenopodium* and *Atriplex*, preferably in May and June, and spraying with lead arsenate or barium chloride, or dusting with calcium arsenate.

Kolubajiv (S.). **Poznámky k biologii mnišky a jejích hlavních hmyzích parasitů.** [Notes on the Biology of the Nun Moth and its chief Insect Parasites.]—*Lesnická práce* **16** pp. 169–199, 2 figs., 58 refs. Pisek, 1937. (With Summaries in German and English.)

The author discusses the value of the insect parasites of *Lymantria* (*Porthetria*) *monacha*, L., in Czechoslovakia, where it is an important pest of spruce [*cf. R.A.E.*, A **22** 427], in greater detail than in a paper already noticed [**25** 526]. A list is given of 52 species of parasites of the moth and of 10 hyperparasites observed in Czechoslovakia, indicating the frequency of their occurrence, their distribution and the years in which they were bred.

The Tachinid, *Phorocera* (*Parasetigena*) *silvestris*, R.-D., is more important than all other parasites together, though it also attacks *Lymantria* (*Porthetria*) *dispar*, L., and possibly *Oeonistis quadra*, L. The moth has, however, a higher biotic potential; the females lay a mean of 150 eggs and begin to oviposit as soon as they have paired, whereas those of the Tachinid lay a mean of 100 eggs and only mature them gradually, so that they are exposed to destruction during a considerable oviposition period. Moreover, though many eggs are laid on one host larva, only one parasite usually reaches maturity; and a larva may sometimes cast off all the eggs when it moults. All stages of *P. silvestris* are more sensitive to changes in temperature and humidity than the host, and many pupae are killed during hibernation [*cf.* **21** 496], whereas the moth overwinters in the egg stage in sheltered positions. The value of the Sarcophagid, *Agria affinis*, Fall., is less, as it probably requires a second host, some of the adults emerging in late summer.

Hymenopterous parasites are much less important, largely because none of them can overwinter in the absence of alternative hosts, and these seldom occur in the dense, badly ventilated spruce stands usually infested by the moth. Of the three species that are occasionally of economic importance, *Apanteles solitarius*, Ratz., which attacks the

very young larvae, is the chief; it was particularly effective during the outbreaks of 1929–34. *Ichneumon disparis*, Poda, which develops in the larvae and emerges from the pupae in the summer or autumn, is sometimes locally abundant, but the average percentage of parasitism by it is not more than 5–10. The abundance of *Pimpla instigator*, F., which parasitises the prepupal and pupal stages, is limited by their short duration and their frequent destruction by various enemies, owing to their exposed position on the trunk or branches of the tree.

Considerable numbers of the Dipterous parasites, especially *P. silvestris*, are themselves parasitised by the Bombyliid, *Hemipenthes morio*, L.

[Kozhanchikov (I. V.).] **Кожанчиков (И. В.). Wachstum und physiologischer Zustand bei Insekten unter dem Einfluss der Umweltsfaktoren.** [Growth and physiological Condition of Insects under the Influence of environmental Factors.] [*In Russian.*]—*Zool. Zh.* **16** no. 1 pp. 88–106, 7 graphs, 31 refs. Moscow, 1937. (With a Summary in German.)

An account is given of detailed physiological investigations on the growth and metabolism of larvae and pupae of *Loxostege sticticalis*, L., and *Euxoa* (*Agrotis*) *segetum*, Schiff., under various conditions of temperature, humidity and feeding. It was found that the influence of unfavourable environmental conditions results not only in a reduced intensity of metabolism, but also in an increased expenditure of energy on the growth of live matter. Moreover, the chemical constitution of protoplasm of individuals subjected to different conditions during their growth is different, and this may lead to an abnormal number of larval instars, or to a diapause. The weight, longevity and fertility of adults also depend on the conditions of metabolism during larval development.

Franssen (C. J. H.). **Biologie en bestrijding van een drietal schadelijke fruitvliegen.** [The Biology and Control of three injurious Fruit-flies.]—*Landbouw* **13** pp. 221–238, 11 figs., 28 refs. Batavia, 1937. (With a Summary in English.)

The following is taken from the summary: Of the indigenous fruit-flies in Java, only three, *Dacus ferrugineus*, F., *D. umbrosus*, F., and *D. cucurbitae*, Coq., cause appreciable injury. The morphology, biology, economic importance, distribution, food-plants and control of these Trypetids is discussed, partly from the literature.

The larvae of *D. ferrugineus* occur chiefly in chillies [*Capsicum*], of which they sometimes infest 100 per cent., and also in mangos, bananas, oranges and coffee berries. They are primary pests of *Citrus* and mango mainly in the case of ripe fruits with thin skins. At Buitenzorg, the incubation period lasted 2 days, and the larval stage in chillies and mangos averaged 7·5 and 6 days, respectively. The pupal stage, passed in the upper layer of the soil, averaged 8 days, and the life of a female in the laboratory 40 days. Several bait-sprays were tested against the adults, but none proved effective. The larvae of *D. umbrosus* are numerous in fruits of *Artocarpus* spp., and cause them to rot and drop. The larval and pupal stages averaged 9 days each, and the life of the female 30 days. *D. cucurbitae* chiefly infests cucurbits and also tomato and papaya. The egg, larval and pupal stages lasted 3, 5–6 and 7 days, respectively.

Fruits may be protected from these flies by cloth bags, and annual crops by planting in isolated fields.

Spoon (W.). **Voorwaarden door den gebruiker aan derrispoeder en derrisstuifmengsel te stellen.** [The Properties required in Derris Powder and Derris Dust Mixture.]—*Tijdschr. PlZiekt.* **43** no. 8 pp. 189–192, 1 fig. Wageningen, August 1937.

For spraying with derris, the usual amount employed is equivalent to 1 part rotenone in 5,000 parts water, others being 1 in 2,500 and 1 in 10,000. A spreader is desirable. A fine derris powder is required to prevent choking the spray nozzles ; at least 90 per cent. of it should pass a sieve with 30 meshes per linear centimetre.

The carrier for a derris dust mixture must be inert. A heavy carrier, such as gypsum, produces a low-lying dust cloud. With a very light carrier, such as kieselguhr, the dust cloud rises easily, while an intermediate result is obtained with kaolin. The specific gravities of the various substances, finely ground so that more than 90 per cent. passes a sieve with 50 meshes per linear centimetre or 125 meshes per linear inch [*cf. R.A.E.*, A **24** 518] are : derris powder 0·56, kieselguhr 0·65, kaolin 0·83, talc 1·12, gypsum 1·33. These data enable mixtures to be prepared with gravities of from 0·6 to 1·2, a mixture light in weight being used for tall trees and a heavy one for low plants. For making a dust mixture with a low content of rotenone, the rotenone content of the derris root powder should also be low, as otherwise there will not be a sufficient number of derris particles to ensure their even distribution throughout the dust mixture.

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